COAL AGE

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The Dust Eaters

By Berton Braley

Written expressly for Coal Age

It is quiet in the breaker—you could hear a cannon clear
If they'd fire it off beside you with the muzzle at your ear
An' exceptin' for the crushers an' the screens an' other gear,
Why, you never hears a solitary sound!
There is coal dust on the winders an' there's coal dust in the air,
It's stickin' to the timbers an' it's settlin' everywhere,
It's clingin' to our eyelids an' our whiskers an' our hair
An' we eats it in the breaker by the pound!

Eatin' the dust,
Eatin' the dust,
Feelin' the breaker throb;
You wouldn't care
To be workin' there,
But it happens to be *our* job!

It ain't ever any picnic when you got to stand an' stand
A turnin' over clumsy lumps that's heavy to the hand,
They say the "joy o' labor" is a thing that's mighty grand
But they otta eat the breaker-dust awhile.
They'd find the same old story in a hundred diff'rent plants,
A lot of dirt an' sweatin'—not a flicker of "romance,"
With the dusty breaker shakin' like a hootchee-cootchee dance,
As the coal comes flowin' downward by the mile!

Eatin' the dust,
Eatin' the dust,
Wishin' the shift was through;
Early an' late
Pickin' the slate
We are the breaker crew!

O the dust is in the breaker an' the dust is in our hide
And it kind of lines our stomachs an' the whole of us inside,
It doesn't help our beauty an' it doesn't help our pride
Though we go on eatin' coal dust day by day,
An' maybe, in the breaker, though it ain't a bit of fun,
We're doin' of our duty in the way it should be done,
For the world's a sort of boiler an' it must have coal to run
So we reckon we are earnin' all our pay.

Eatin' the dust,
Eatin' the dust,
(Rumble an' crash an' bang!)
Husky an' rough,
Dusky an' tough,
We are the breaker gang!

Education in Coal Mining

By J. T. Beard

An Outline of the Next Question for General Discussion

We propose during the month of April to discuss broadly the question of the need of education in coal mining. We want to ask: What is education as applied to the mining of coal? Has the miner any need of more than a common-school education? Many miners today went into the mine as trappers or oilers at the age of nine or ten years, and if they know how to read and write, they are fortunate.

The average miner's knowledge of arithmetic goes no further than the four rudimentary operations—addition, subtraction, multiplication and division. Fractions are to him an unexplored wilderness. He knows nothing of percentage, ratios, decimals and other simple processes that are necessary in the solution of mining problems. He knows nothing of geometry—of lines and angles. He cannot read a mine map intelligently.

However, notwithstanding these untoward conditions, many miners have, with keen insight, discovered what education has done to advance the earning power of men around them, and are today reaching out for the same knowledge that will enable them to, at least, hold their own in the unequal race of life.

Regarding now the ambitious English-speaking miner who aspires to learn such principles, methods and processes as will increase his efficiency, and incidentally, his earning power, what are the essential qualities of such an education? Shall we call it education or training?

Recognizing the responsibilities that rest upon all mine workers alike to perform their work in a manner that will not endanger themselves or their fellows, and the greater responsibility of men who must act in an official capacity in the operation of mines, the mining laws of most states require the examination of all miners, mine foremen and firebosses, before they can enter upon their duties in the mine.

This requirement by law, is quite generally, we might say universally conceded to be right and just as a necessary protection against the dangers that would arise from the presence, in the mine, of men unfamiliar with mining conditions. The ignorance of a single worker may cost the life of every man in the mine. The first principle of safety, then, is the education or training of all mine workers.

The question has been asked many times in the last few years: What should be the character of mining examinations? It is important to discuss this question in all its bearings. It is a broad question. The views of practical men and prospective candidates are necessary to reveal the difficulties that confront men who must pass such examinations.

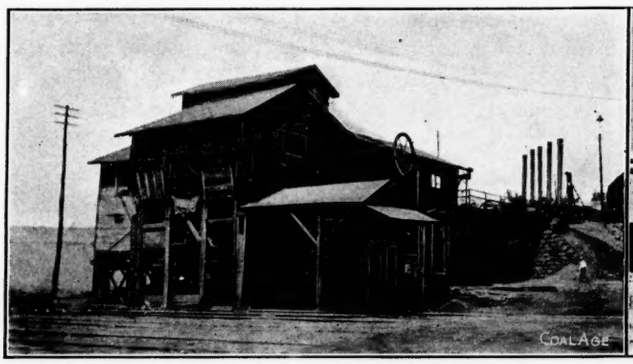
Of equal importance are the views of practical mining men who have made a study of mining conditions and are able to apply the theory and principles of mining in the solution of every-day problems, in the mine. It is these men, alone, who understand fully the relation of education to mining.

On the other hand, it is desired that the members of examining boards should take part in this discussion, and give their reasons why the examination is not made to conform more closely to the practical requirements of the men whom they are to certify as qualified for mining positions. Let these men say, if they can, why the examination of practical men should not be made to conform to the conditions in practice. Why, if the man in practice makes frequent and common use of mining textbooks should he not be allowed to use the same books in the examination that is to determine his ability to solve the given problems.

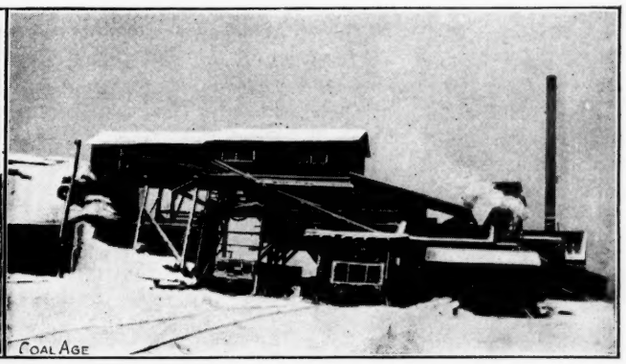
An unprejudiced mind will allow that to eliminate the use of textbooks, in certain sessions of mining examinations, is to give undue advantage to the man who is able to memorize formulas and constants; while the generally more able man, from a mining standpoint, is placed at a decided disadvantage because he is denied the privilege of working under the same conditions to which he is accustomed in the mine and in the office.

As secretary of the state mining board, for a number of years, I have seen good practical men abandon the examination and give their reason for not finishing the work, that they could not remember the formula that they wanted to use. There is an earnest call for the general use of textbooks in all sessions of mining examinations when practical problems must be solved. College students are now allowed to use textbooks, in such examinations; because it is realized that the requirements have become too severe to expect students to memorize what they should find in a reference book. We are glad to say some states have adopted this method. Why not all? Is the delay due to a desire on the part of some members of every examining board to hold in their possession the key that will make them the masters of the situation?

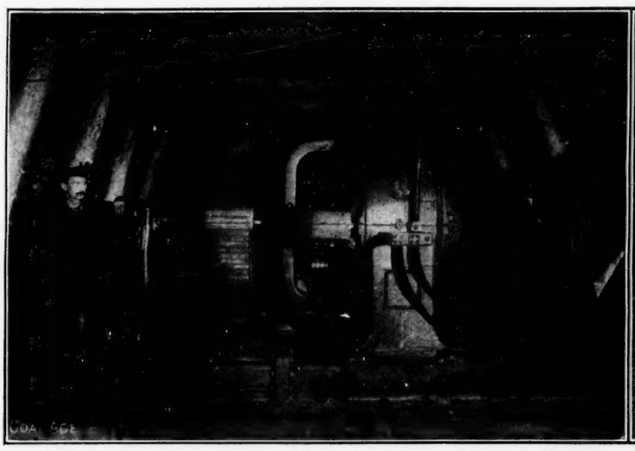
SNAP SHOTS IN COAL MINING



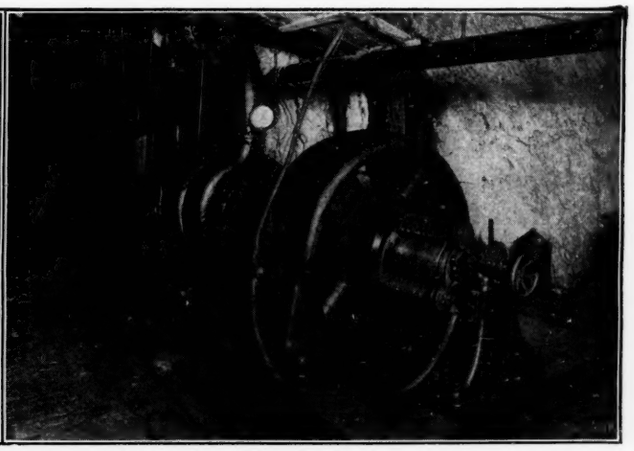
No. 9 Tipple of St. Bernard Mining Co., Earlington, Ky. Built 40 Years Ago and Now the Second Oldest Tipple in the Field



No. 11 Mine of St. Bernard Co. at Earlington. Oldest Tipple in Western Kentucky. Still Loads on an Average of 700 Tons per Day



Underground View of 10-in.. Quintuplex Pump, Driven through Gears by 170-hp. G. E. Motor. Operating Head 400 Ft. Kohinoor Colliery Shenandoah, Penn.



Centrifugal Pump Operating against 330-ft. Head, Capacity 1000 G. P. M. Driven by G. E. 150-hp. Motor. North Franklin Colliery. Treverton, Penn.

Showing Tipple and Miners' Houses of Wyoming Coal Mining Co., at Monarch, Wyo.

Simple Flywheel Calculations

By Chas. W. Beers*

SYNOPSIS—In a simple manner that anyone possessing a knowledge of only the rudiments of algebra can easily understand, the author develops the various formulas used in flywheel computations. He also shows how to obtain, in the case of a planer, the experimental data necessary before calculations can be undertaken.

The object of any flywheel is to equalize the energy and the work done, on or by, any piece of machinery in which the load varies through large and comparatively quick changes, thereby preventing sudden speed variations in the driving apparatus, due to the amount of the resistance to be overcome.

Sometimes flywheels are installed for economic reasons. This condition is frequently thrust upon those who purchase electric power on a minimum demand basis. This state of affairs is often encountered by large coal operators in Germany (and in this country, also) who find it economical to make use of large flywheels on their shaft hoisting equipments, thus reducing the demand peak loads to practically ⅓ or ¼ of what they ordinarily would amount to without the flywheel.

This is well illustrated in Fig. 1, which shows the peak load on the hoist motor compared to the demand peak as required by a flywheel motor-generator set from which the hoist motor is operated.

To illustrate the manner in which a flywheel gives up its energy in order to overcome extreme load fluctuations, let us take the case of the ordinary punch-press. When the press was initially started, considerable energy was expended in bringing it up to speed, much of this being due to the flywheel.

This starting load decreases rapidly as the press comes up to speed, but the instant the punch enters the metal plate the speed begins to decrease, owing to the large resistance encountered. It is at this instant that the flywheel comes into service, for as soon as the decrease in speed occurs, the energy that was originally put into the wheel when bringing it up to speed is given out in an effort to prevent this speed decrease. This energy, is, of course, expended on the punch, and assists in driving it through the metal. As soon as the punch is complete, the press begins to speed up again, thus storing more energy into the wheel where it becomes available for the next punch.

In the preceding paragraph, we have intimated that the amount of energy given up by a flywheel is proportional to the energy *input,* when changing from a lower to a higher speed. It has also been intimated that the amount of speed change permissible is one of the important factors in the correct design of flywheels. The determination of these two points has been a stumbling block to many, and it might be well at this time to make these points clear.

The Mathematics of the Flywheel

It is well known that work equals the product of force and space or the distance through which this force moves. Expressed mathematically this becomes

$$\text{Work} = F \times S$$

The fundamental definition of force (F) says Force is equal to mass times acceleration, or

$$F = M \times A$$

and since the mass of any body is equal to its weight (W) divided by gravity ($g = 32.2$), or $\frac{W}{g}$, we see that the work or energy in any moving body is:

$$E = \frac{WAS}{g}$$ (by making proper substitutions for F and M).

Let t = time in seconds required to bring the speed of the given weight (W) up to a uniform linear velocity of

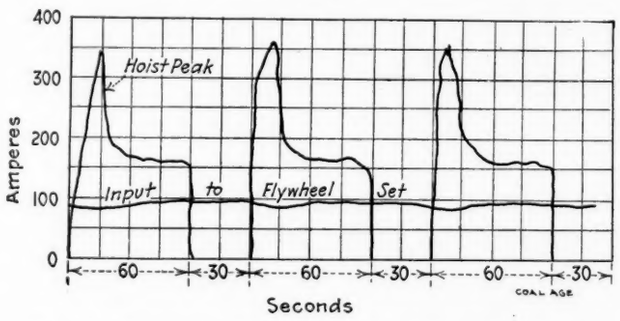


Fig. 1. Showing Input to Flywheel Set When Buying Power on Demand Basis

V ft. per second; then during each succeeding second of t, the speed was increased by $\frac{V}{t}$ ft. per second, hence we say the acceleration (A) $= \frac{V}{t}$ ft. per second. Substituting this value of A in the above formula, $E = \frac{WAS}{g}$, we obtain

$$E = \frac{WVS}{gt}$$

but S, or the space traveled in t seconds $= t\left(\frac{0 + V}{2}\right) = \frac{Vt}{2}$ (at instant of starting the vlocity was zero, and at end of acceleration period of t sec. the velocity was V ft. per sec., therefore the average velocity $= \frac{0 + V}{2}$, and the space traversed in t sec. at an average velocity of $\frac{0 + V}{2}$ ft. per sec. $= \frac{Vt}{2}$). Therefore, substituting this value of S in the expression $E = \frac{WVS}{gt}$, we have

$$E = \frac{W \times V \times Vt}{g \times t \times 2} = \frac{WV^2}{2g}$$

This is the formula for the energy stored in a moving body during its acceleration period, or the time required to bring it from zero speed up to full speed. In the same way it can be proved that if the weight W had its speed accelerated up to V_1 ft. per sec., the energy stored in it would be $\frac{WV_1^2}{2g}$.

Hence if the weight W, while in motion, had its ve-

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velocity reduced from V ft. per sec. to V_1 ft. per sec. the energy change would equal

$$\frac{WV^2}{2g} - \frac{WV_1^2}{2g} = \frac{W}{2g}(V^2 - V_1^2)$$

It will be observed that this expression is in terms of foot-pounds per sec. (Since V = velocity in feet per sec.) and since one horsepower is 33,000 ft, lb. per minute or 550 ft. lb. per sec., then dividing the above final expression by 550 will give the amount of power in terms of horsepower seconds.

The expression $\frac{W}{2g}(V^2 - V_1^2)$ is the fundamental equation of the flywheel, and shows that the amount of energy that is stored up or given out, is proportional to the squares of its particular velocities. Conversely, since $E = \frac{W}{2g}(V^2 - V_1^2)$, and its value is known, then by simple transposition we get

$$\frac{2gE}{V^2 - V_1^2} = W$$

which is the expression used for determining the effective flywheel weight.

This equation is also important is it shows that the greater the effective velocities are, the less is the required weight in the wheel, and consequent cost.

The Limit Set by Experience

Practical experience in electrical work has limited the change in speed from V to V_1 such that $V - V_1$ shall not greatly exceed 15 per cent, as beyond this point the energy gain is not so valuable in dollars and cents, all things considered. Individual cases may arise, however, in which it would pay to greatly exceed this figure. Therefore, in order to get the greatest value possible out of the expression $V^2 - V_1^2$ it is necessary to use the highest speed possible for V, consistent with safe rim construction.

In ordinary cast-iron wheels, the safe peripheral speed is quite low (3000 ft. to 5000 ft. per min.); in cast-steel wheels it is considerably higher, amounting to an average of 18,000 to 20,000 ft. per minute; steel plate wheels (those built up from steel plate) have safe velocities as high as 24,000 ft. per mn. From this it is readily seen that the effective weights for wheels of the above materials differ considerably, varying in the proportions of $\frac{1}{5000^2} : \frac{1}{20000^2} : \frac{1}{24000^2}$.

Up to this point in the discussion, the term velocity has been used in a general sense.

The formula $\frac{W(V^2 - V_1^2)}{2g}$ shows the importance of V in these calculations, hence for any particular flywheel, it is necessary to have some definite value therefor. This value is taken as the linear velocity per second of some point in the plane of the wheel, such that if the entire weight of the wheel were conceived to be concentrated at that point, it would still have the same energy effect as where distributed in hub, spokes and rim.

This point is known as the "center of gyration," and its distance from the center of rotation of the wheel is called the "radius of gyration." To the ordinary mind, the conception of this point may cause some mental gymnastics; such a point is, however, a mathematical fact, and its location and uses are essential to flywheel calculations, but the definition, as given above, is sufficient for this article.

In the type of wheel ordinarily employed, in which the depth of rim bears an appreciable ratio to the outside rim radius, the value of the radius of gyration is $\sqrt{\frac{r^2 + r_1^2}{2}}$, where r is the outside, and r_1 the inside rim radius. (In this type of wheel the hub and arms may be neglected with perfect safety. They introduce complications, and contribute but little to the finesse of the result.) For the plate, or flat type of wheel in which $\frac{r - r_1}{r}$ is very small, or does not exist at all, the radius of gyration is $\sqrt{\frac{r^2}{2}} = 0.707r$.

A Supposed Case

Suppose that a complete cycle of power has been calculated (or otherwise obtained) for a punch press, and it has been found that a flywheel could be used to advantage, and that it is required to give out energy to the amount of 24.5 hp.-sec. to assist the punch.

Now,

$$24.5 \textit{ hp.-sec.} \times 550 = 13{,}475 \textit{ ft.-lb. sec.} = E$$

but

$$E = \frac{(V^2 - V_1^2)}{2g}$$

Equating these,

$$13{,}475 \times 64.4 = W(V^2 - V_1^2)$$

Since the energy required is not large, the wheel will be rather small, and we may assume it to be made of cast iron, and its safe peripheral speed may be taken at one mile per minute or 5280 ft., or 88 ft. per sec.

If D = dia. of wheel in feet, and S = its rev. per sec. $= \frac{\text{r.p.m.}}{60}$ then $\pi DS = 88$ *or* $DS = 28$. In order to make the wheel low in cost, we may assume it to have a speed of 7 rev. per sec. and the outside diameter D of wheel will therefore be 4 ft. A good, stiff rim section for a wheel of this type would be 6 in. in depth and 2 to 3 in. in width, and if the outside rim radius r = 24 in., then r_1 = 18 in. and the radius of gyration $= \sqrt{\frac{24^2 + 18^2}{2}} = 21.21$ in., and the velocity per sec. of the radius of gyration equals

$$\frac{7 \times 3.1416 \times 21.21'' \times 2}{12} = 77.77 \textit{ ft.}$$

Let the speed drop = 14.4 per cent. Then the final velocity of the center of gyration is 77.77 − (14.4 per cent. of 77.77 ft.) = 66.57 ft. per sec.

Substituting these values of V and V_1, in the expression $13{,}475 \times 64.4 = W(V^2 - V_1^2)$ we obtain W = 536 lb., which equals weight of wheel required. From this amount deduct 86 lb. for hub and arms. We now have 450 lb. equals the weight of rim.

To determine a correct section, let us assume the rim to be d in. wide, and since it is 6 in. deep, then its cross-sectional area = $6d$ sq.in. The mean dia. of rim is 3 ft. 6 in., consequently the rim volumne = $792d$ cu.in., and if 1 cu.ft. of cast iron weighs 450 lb. then since the rim weighs 450 lb., its cubic content must be 1728 cu.in. = $792d$., or d = 2.2 in. = thickness of rim.

The Value of E Should Be Known

In the above discussion it will be observed that the value of E was assumed; this was done simply to show the method of using the formulas as far as the actual calculations of the flywheel itself were concerned.

In almost all flywheel calculations, it is necessary that the value of E be known, and usually the conditions of the problem are such that this value can be readily determined, either by actual calculation of the total cycle, as would be the case in new machinery design, or by means of graphic curve drawing meters, properly applied to existing machines. The latter method is more accurate, and has the advantage of simplicity and reliability.

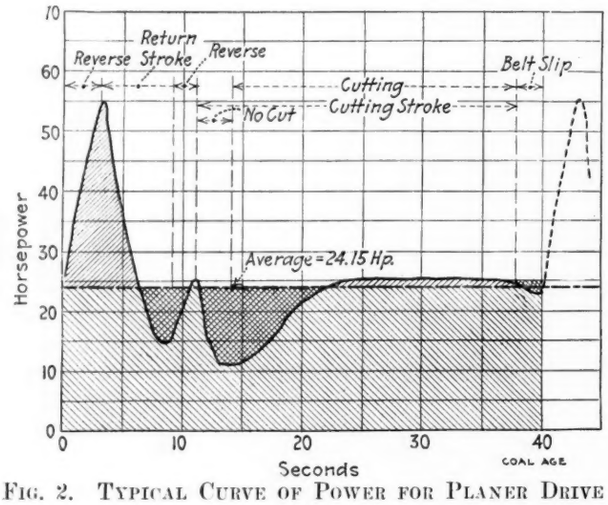

Fig. 2. Typical Curve of Power for Planer Drive

To make this clear, let us take the case of a large motor-driven planer, with a small flywheel attached, and, further, let it be assumed that it is desired to operate on heavier work, and that the present flywheel and motor have been found, by experiment, to be inadequate to properly meet these conditions. These would be excellent reasons for increasing the flywheel capacity of the machine and the method of procedure would be as follows:

Remove the present motor and flywheel, and attach a trial motor of same speed as original one, and of a capacity sufficiently large to perform the new operation without serious effort. A graphic curve ammeter is then properly inserted in the motor circuit (it may be found necessary to increase the speed of chart in order to get a diagram of respectable size).

The motor is then started up and the planer is operated at its desired capacity. At the conclusion of the test run, the graphic record should be carefully examined. This chart will be somewhat similar to Fig. 2, which may be taken as a type curve for one cycle of operation only. The consesecutive steps in the process are clearly shown in the figure.

Now, if the total area of this cycle, expressed in hp.-sec., is divided by the length of the cycle in seconds, the result will be the average hp. required and indicates the size of motor that may be used on this planer, when provided with the proper size of flywheel. If such be the case, then the energy above the average line will be supplied, or given out, by the wheel, and that below the line will be supplied by the motor.

The cross-hatched portion below the line shows the energy, E, supplied by the motor to the wheel. The following calculations give the total hp.-sec. in the chart for one cycle, and also indicate the method used in determining the same:

Hp.-sec. at reverse for return stroke =	$\frac{24+55}{2} \times 3 = 118.5$
Hp.-sec. at return stroke =	$\frac{55+15}{2} \times 5 = 175.0$
	$15 \times 1 = 15.0$
Hp.-sec. at reverse for cutting stroke =	$\frac{15+25}{2} \times 2 = 40.0$
Hp.-sec. at cutting stroke (cutting) =	$\frac{11+25}{2} \times 9 = 162.0$
	$\frac{25+11}{2} \times 2 = 36.0$
Hp.-sec. at cutting stroke (no cut) =	$11 \times 2 = 22.0$
Hp.-sec. at belt slip at end of cutting stroke =	$\frac{25+23}{2} \times 3 = 72$
Totals	$\frac{}{40}$ sec. $\quad \frac{}{965.5}$

Then $965.5 \div 40 = 24.15$ hp. average.

Now the areas of the cross-hatched portions below the line are equal to the energy (hp.-sec.) supplied to the wheel by the motor, and, as indicated by the curve, this is given up by the wheel during each cycle, hence, if we determine the total of all areas above the line, we know the exact hp.-sec. or E that the flywheel must be designed for.

The Calculation of the Energy

This total area is as follows:

Hp.-sec. at reverse for return stroke =	$\frac{55-24.15}{2} \times 6.5 = 100.26$
Hp.-sec. at reverse for cutting stroke =	$\frac{25.5-24.15}{2} \times 1 = 0.67$
Hp.-sec. at cutting stroke =	$\frac{25-24.15}{2} \times 2 = 0.85$
	$(25-24.15) \times 13 = 11.05$
	$\frac{25-24.15}{2} \times 1.5 = 0.64$
Total hp.-sec.	113.47

Call it 113.5 hp.-sec.

Now one hp.-sec = 550 ft.-lb., therefore $113.5 \times 550 = 62{,}425$ ft.-lb.-sec. equals the value of E, or the energy necessary to alternately absorb and give up. By equating this value against $\frac{W(V^2-V_1^2)}{2g}$ and following the method indicated in the fore part of this article, the required size of flywheel may be easily determined to meet the above conditions.

In this discussion it has been the aim of the writer to illustrate the application of formulas in such a manner as to make the subject matter of interest to those who are not familiar with flywheels, and no effort has been made to introduce those finer details which, while they beautify the problem, quite often prove to be more of a hindrance than an assistance, and which have no direct value unless they are well tempered by experience. The hub and arms of any wheel have a definite effect upon the energy which may be stored up or given out, but this is ordinarily so small that it may be safely disregarded.

In conclusion the writer wishes to make acknowledgment to the *General Electric Review* dated June, 1912, for Fig. 1, which occurs on p. 401 of that issue, while Fig. 2 is reconstructed from Fig. 1, p. 79 of the same periodical for February, 1913.

Coaling Plants at Panama Canal

SYNOPSIS—Coaling stations are to be established at both ends of the canal. That at the Atlantic terminus is approximately twice the capacity of the one on the Pacific side of the isthmus. This article treats in more or less detail of the facilities and equipment necessary for loading, unloading and storing the coal.

(*Announcement of Isthmian Canal Commission*)

Speed in handling coal with the least possible amount of breakage is the main requirement of the coaling plants to be established at the Atlantic and Pacific entrances to the Panama Canal, at Cristobal and Balboa, respectively. Specifications for the machinery of the two plants have been completed and advertisement will shortly be made for bids.

Coal for Use in War Will Be Stored under Water

It is planned to have a coal-storage basin at Cristobal with a capacity of 290,000 tons, and one at Balboa with a capacity of 160,000 tons. In each place the storage will be within a large basin made of reinforced concrete, in which approximately half of the coal will be stored under water for use in time of war, and the other half above water to be added to and taken from continually for the ordinary uses of commercial and government vessels. It is also planned, if the policy should be approved, to be able to lease parts of the storage basin to such private coaling companies as may wish to maintain their own coal stores on the isthmus; but in such cases all of the handling will be done by the government plant, a suitable charge being made for the service.

The specifications are not hard and fast, but merely establish certain general methods and standards, leaving it to manufacturers to devise suitable machines. One of the limiting conditions is that the government shall build the substructure or storage bin and place upon the walls such tracks as cranes and other movable machines may require. This substructure will cost more than the coal-handling plant. The details will not be decided upon until the bids for the handling plant have been canvassed, because each plan will require its own special substructure, and one of the points considered in awarding the contract will be the cost of the substructure required under each plan.

Ships To Be Coaled from Barges, Not from Pockets

In general, however, the specifications call for cranes that will unload coal from ships; a conveying system that will transfer it to bridges that will span the storage basin and dump it at any place desired; and such a system of buckets operating upon these bridges as will make it possible to lift coal from the storage basin, and by means of conveyors raise it to loading machines that will dump it into colliers or lighters. The Cristobal plant must be capable of unloading 1000 tons and loading 2000 tons of coal each hour, and the Balboa plant 500 and 1000 tons.

In the ordinary operations of each of the plants, vessels requiring bunker coal will not go alongside the wharves of the plants to receive such coal, but will be coaled while lying in the stream from barges laid alongside, these barges having been loaded by means of the reloaders forming part of the specified handling machinery for each plant.

The storage basin at the Atlantic entrance will be 1000 ft. long and 250 ft. wide. The bottom of the basin will be 19 ft. below mean tide, and the elevation of the decks of the wharves 10 ft. above mean tide. There will be 41 ft. depth of water alongside the wharves. The wharves will be founded upon steel cylinders filled with reinforced concrete resting upon hard rock. The maximum tidal oscillation in Limon Bay is 2.65 ft.

For this type of storage basin, at least two layouts of coaling plant are feasible; the first being that in which the loading and unloading wharves occupy opposite sides of the basin parallel with one another with the coal piles between them, and the second that in which the unloading wharf will be at right angles to the loading wharf. The normal capacity will be 240,000 tons, capable of increase to 290,000 tons by piling coal to 10 ft. additional height.

The coaling plant at the Pacific entrance will be on the quay wall south of the entrance to the large drydock. The size of the basin will be 500 ft. long and 250 ft. wide for one design of plant, and the same length and 340 ft. wide for a second design. The extreme tidal difference here is 21.8 ft. As at the Atlantic entrance, the loading wharf will be founded upon concrete cylinders resting upon hard rock; the unloading wharf will be gravity section concrete wall resting on rock. The normal capacity of the Balboa plant will be 135,000 tons, capable of increase to 160,000 tons, by piling coal 10 ft. above normal height.

In the first plan a basin 500 ft. long and 250 ft. wide is provided for, with bottom at 18 ft. below mean tide and top of wharf at 16½ ft. above mean tide. The capacity of this plant must not be less than 500 tons of coal an hour to be unloaded and 1000 tons per hour to be loaded aboard colliers or barges. Two unloaders will be required with conveyors, and two single stocking reclaiming bridges. Two reloaders will also be required. The operation of this plant is essentially the same as that for the Atlantic entrance.

Alternate Plan Provides Larger Basin

An alternate plan for the Balboa plant provides for the same location of the wharves, but for a basin 500 ft. long and 340 ft. wide. The unloaders are the same as in other plans, but instead of dumping into conveyors they will discharge by means of the cantilever end directly into the basin, and large cantilever cranes will then pick up the coal and deposit it at any desired point in the storage basin. For reclaiming, these same cranes will pick up the coal and trolley it into their towers, where it will be dumped into cars or other conveyors, whence it will be carried away from the basin, along the front of the reloading wharf to the reloaders.

The purpose of this second plan is to make use of four berm cranes now used in the placing of concrete at Miraflores Locks and thus save the expense of the stocking and reclaiming bridges. Whether they will be used depends upon the cost and general desirability of this plant compared with one having entirely new handling machinery.

Units of the Plants

The following paragraphs refer particularly to the Cristobal plant, but with certain modifications, as indicated above, apply also to the Balboa plant.

The unloading operation will consist of taking coal from a collier and depositing it any desired place in the bin or basin. For this purpose unloading towers, a conveying system that will carry the coal lengthwise of the storage bin along the wharf, bridges spanning the basin, and a conveying system upon these bridges, which will take the coal from the first conveyors and dump it wherever required, are specified.

Four unloading towers of not less than 250 tons capacity per hour each, making a total capacity of 1000 tons an hour, form the first unit of the unloading system. These towers must be capable of mining coal from a vessel and depositing it into a hopper built within the tower, whence it may be delivered by chutes to the conveying system, or to Panama R.R. cars running on a track beneath the tower; or of depositing it by the bucket or shovel into the storage pile behind the tower; and of mining coal from storage pile behind the tower and depositing it in the hopper in the tower.

Each tower will travel on two parallel pairs of rails between which, at the level of the wharf deck, there shall run a railroad track so located that cars may be run beneath the unloading tower and receive coal from its hopper. The speed of travel in either direction must be not less than 50 ft. per min. against a wind pressure of 10 lb. per sq.ft. The track travel must be by motors or engines within each tower, and not by cable drive.

The bucket or shovel by means of which the tower will mine coal from the colliers will have a capacity of 100 cu.ft. liquid full. Larger buckets may be offered, however, provided small buckets are also supplied and a rapid means of making the change from one to the other is provided.

General Construction of Towers

Each tower will be fitted with a lifting or folding boom on the water side and with a cantilever on the storage-basin side. The cantilever may be movable if necessary to permit the passage of the reclaiming bridges. In any case the track for the trolley of the bucket shall be horizontal and continuous, between the extreme ends of boom and cantilever, when both are in a horizontal position, and the passage of the trolley over the hinge joints shall be made easily and without shock. Suitable buffers will be fitted at each end of the trolley runway. The distances through which the trolley or bucket will be capable of operation are as follows: Maximum height above wharf level. Balboa and Cristobal, 60 ft.; maximum depth for reclaiming coal from ships below wharf level, Cristobal, 30 ft.; Balboa, 45 ft.; maximum horizontal travel of bucket on water side beyond center line of tower legs next to water, Cristobal and Balboa, 60 ft.; maximum horizontal travel of bucket on land side, beyond nearest wall of coal basin, Cristobal and Balboa, 35 ft.; maximum depth below wharf level for reclaiming coal from storage on land side at Cristobal, 29 ft.; maximum depth below wharf level for reclaiming coal from storage on land side at Balboa, 34½ ft.

In addition to these operations the towers will be able to dredge the bottom of the slip in front of the unloading wharf 51 ft. below wharf level at Cristobal and 61½ ft. at Balboa.

Conveying System

The conveying system must provide for the transfer of coal from the unloading towers along the wharf to any point at which the bridges may be spanning the bin, and the transfer along the bridges to any point desired, where it may be tripped into the storage basin. It must have a sufficient capacity to handle the maximum amount of coal delivered by the unloading towers. It may consist of either cars or trains propelled by electricity or cable, belts or continuous conveyors of similar construction, or any other approved, tried out and guaranteed means of doing the work, due regard being had to the basic requirement that breakage of coal in handling must be reduced to a minimum.

At the Cristobal plant the conveying system must be capable of performing any one of eight specified operations, so as to facilitate in general the processes of unloading coal from one or two vessels simultaneously and conveying it either to the storage pile, the reloaders or the wharf bunkers, or of conveying coal from the storage pile itself to the reloaders, and in such manner that these various operations shall interfere with each other as little as possible. At the Balboa plant the requirements are similar but are necessarily modified by reason of the smaller size of that plant and the use of the berm cranes referred to.

Four Bridges across Basin—Reloaders

Two duplex or four single bridges are required in the proposed plan for the Cristobal plant. The former are fitted with two shovels or buckets, and the latter only one each. These bridges will span the coal-storage basin over the coal piles and move along the walls longitudinally of the basin, so that they can cover any point in the basin. Upon them will be mounted the conveyors, that will carry coal from the conveyors upon the walls to any point desired within the basin; and the shovels or buckets that will mine coal from the basin and carry it to the conveyors, which will transfer it to the wharf bunker and to the machines for loading it upon colliers or barges.

The reloaders will be machines moving longitudinally along the wharf at which colliers and barges will tie up to receive coal. They will move by their own power, but not by cable. They will receive coal from the conveying system and deliver it to the vessels, and, to this end, will be fitted with the following essential parts: (*a*) A hopper or hoppers for the reception of coal from the conveying system of sufficient size to regulate the flow of coal; (*b*) a conveying system to transfer coal to the discharging end of the reloader; and (*c*) an adjustable arm or boom equipped with a telescopic chute to deliver coal with a minimum of breakage. This boom will house in sufficiently to lie entirely behind the plane of the front wall of the wharf when the reloader is not in use, in order that the reloader may be moved past shrouds, yards, upperworks, rigging, etc., of vessels lying at the reloading wharf. The extreme conditions of discharge that must be met by each reloader cover such matters as size of cargo holds and hatches in vessels, distance of vessels from wharf, distance of deck of vessel above or below deck of wharf, etc. The reloader must also be able to adjust itself to various minor conditions peculiar to each vessel.

Electric Equipment at a Sumatra Mine

By Alfred Gradenwitz*

SYNOPSIS—A brief description of the electrical equipment at the Ombilin mines on the west coast of Sumatra. The installation is quite elaborate and modern in every respect. Electricity is used for hauling, lighting and pumping.

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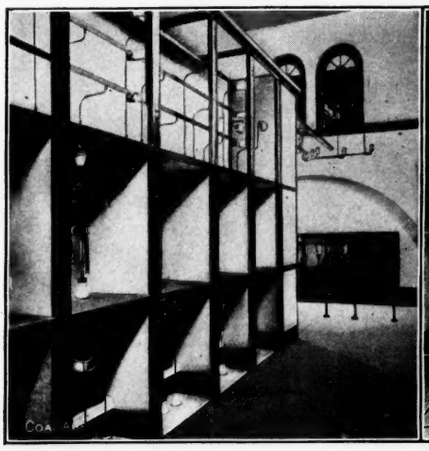
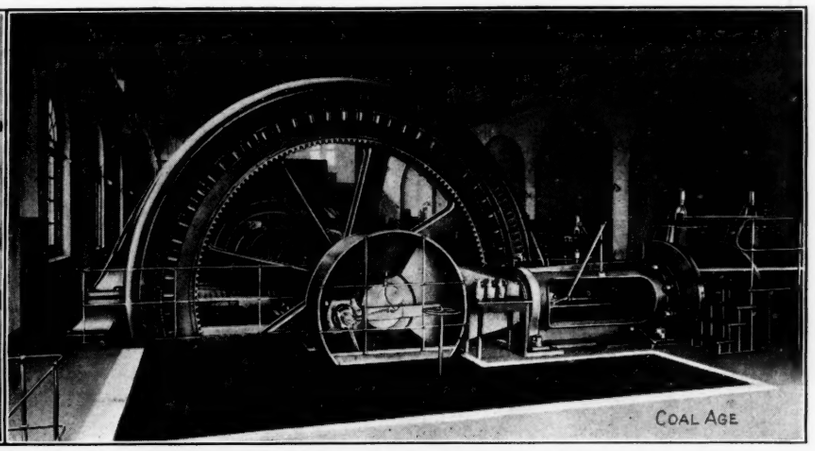
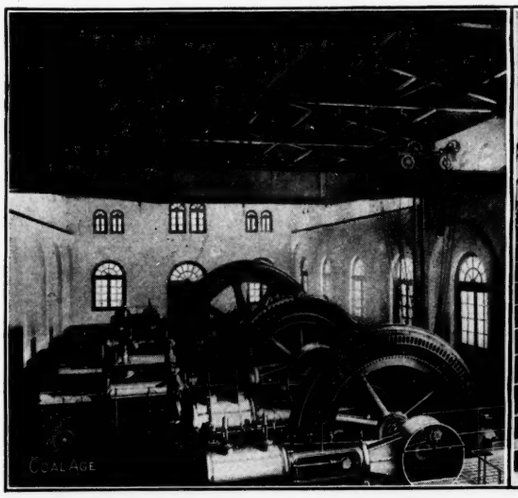
Electric operation was started as far back as in 1905 at the Ombilin coal mines, situated on the west coast of Sumatra, near Sawah-Loento, with a 900-kv.-a., 3-phase steam dynamo, to which a 500-kv.-a. generator was added in 1907 and a 1450-kv.-a. unit in 1911. The generators are driven by horizontal, compound engines, manufactured by Stork & Co., of Hengelo.



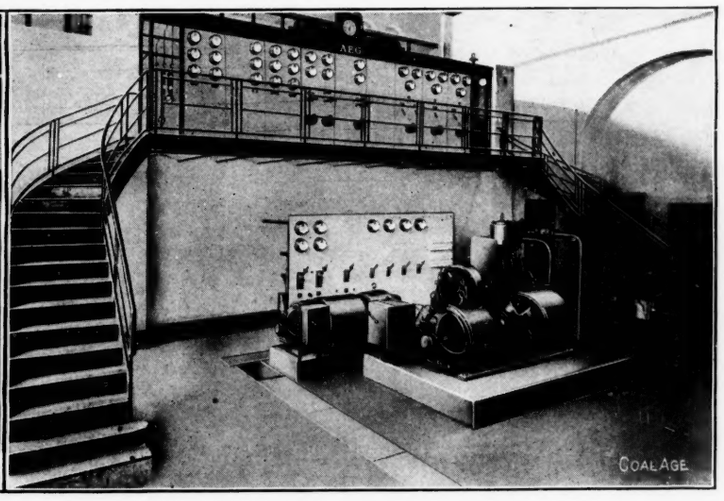
Back View of Switch Gear



1450-kv.-a. Three-phase Generator for the Ombilin Coal Mines



Interior View of Power Station

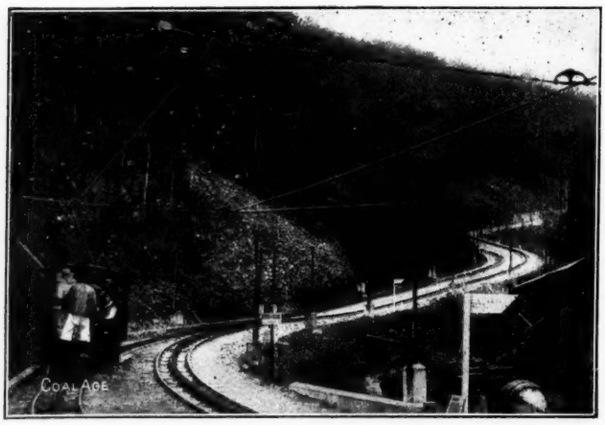


Front View of Switch Gear

Three-phase current is generated at a pressure of 6000 volts and is distributed, through overhead transmission lines, to the points of consumption where it is transformed down to a pressure of 225 volts. A curious feature of the mines is that there are no deep workings and therefore no electric winding plants are required. Drift mining is used and there are three different seams worked. The coal is hauled on tracks having 600-mm. gage, and electric mine locomotives with adhesion drive. Since the mines are situated at a higher level than the town of Sawah-Loento where the railway—155 km. in length—to Padang and Emmahaven begins, the coal trucks are taken down on a chain railway to the screening house for sorting and loading into railway trucks.

An electric rack railway (see next page) runs parallel to the chain railway; this latter was constructed in the year 1908. It is used for carrying coal, but principally for taking up materials, mine timber, etc. The service is carried on with 7 electric rack locomotives; a photo of one of these on a trial track installed for experimental purposes is shown herewith. Besides for the transport and lighting, the current generated is chiefly employed for driving pumps, compressors, fans, small winches, and in the briquette factory, the screen house and the workshops.

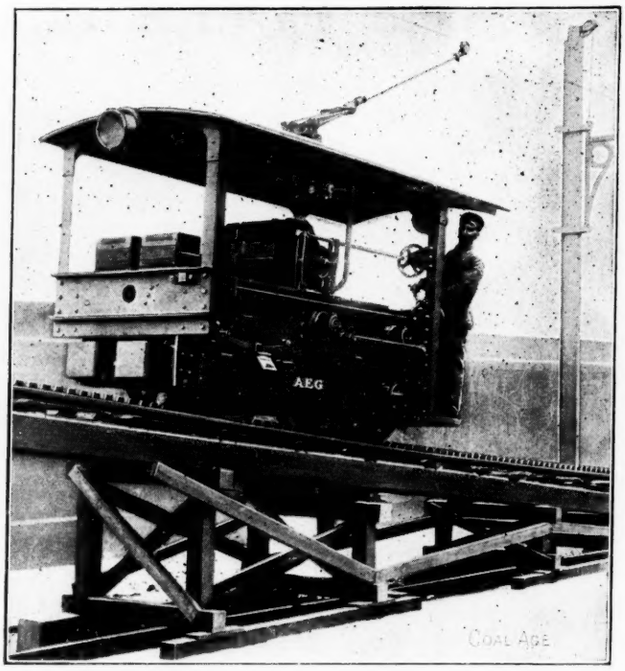
*Gosserstrasse 20, Berlin, Friedenan, Germany.



INCLINED ELECTRIC RACK-RAIL HAULAGE SYSTEM

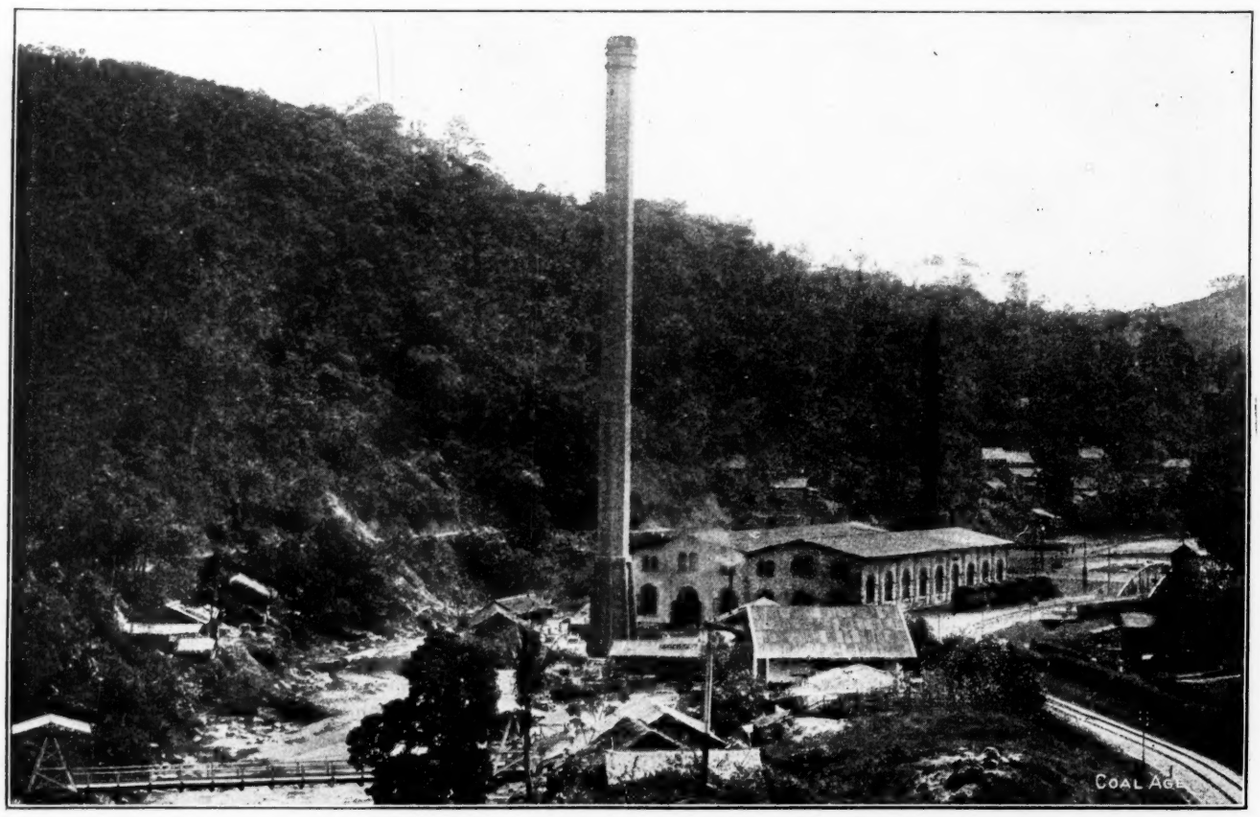
On the Ombilin River, 8.5 km. from Sawah-Loento, there is a pumping station for supplying water to the highest level of the mines. At the present time this station contains 2 centrifugal pumps for 1200 litres with a manometric lift of 424 meters; the pumps are driven by 200-hp. three-phase motors, running at a speed of 3000 revolutions per minute. With the increase in the output, which now amounts to approximately 1300 tons per day, on the average, the demand for electricity has also increased and the extensions to the power station have had to keep pace accordingly.

In the year 1907 the boiler house, which was originally equipped with three Steinmüller boilers, each having a heating surface of 240 square meters, was extended by adding two further units of the same kind.



VIEW OF RACK-RAIL LOCOMOTIVE

In 1911 a superheater was added and the iron chimney replaced by a reinforced concrete one. A view of the power station, which is situated on the small Loento River, is given herewith. The latter supplies the cooling water to the condenser, but during the dry season there is sometimes very little available.



GENERAL VIEW OF POWER PLANT, WHICH IS OF A MODERN AND PERMANENT CHARACTER

The switch gear, which was not originally designed with a view to the extension of the power station, was entirely reconstructed in the year 1911, in accordance with the most recent practice. The building was extended at the back, a double busbar system was installed and the whole of the high-tension apparatus was arranged on the cell system, all these alterations being made without the slightest disturbance in the service of the station. The oil switches for the generators were fitted with remote control and automatic release by means of maximum and reverse current relays, and the switches for the transmission lines and transformers were arranged for hand operation with magnetic maximum release. A small battery of accumulators was installed for the remote control of switches, relays and emergency lighting. The lightning-arrester plant was also improved; each phase of all the transmission lines was fitted with rough and fine protection horn arresters, and water resistances mounted in cells, while water jet, earthing devices were connected to the busbars. The switchboard and high-tension room are shown in the accompanying illustrations. Since the recent improvements and extensions have been completed, the power station may be regarded in every respect as a model installation. It is now intended to modernize the transmission line and transformer stations in accordance with the more exacting requirements they have at present to comply with.

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Electricity in a Group of Mines

SPECIAL CORRESPONDENCE

SYNOPSIS—Aside from some of the equipment at one shaft, every one of the twelve operations of the United States Coal & Coke Co., in McDowell County, W. Va., is electrically driven from a central power station. This article enumerates most of the apparatus and gives some interesting figures on percentage of motor to generator capacity.

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In extensive mining operations, the problem of supplying power to the various workings, which may be quite a distance apart, is best solved by electrification. The flexibility of an electric equipment, permitting the installation of motors at any point to which wires may be run, the ease of control of electrically driven machinery, the reliability and economy of the electric installation, all make for the most successful and economical operation.

The extensive mining operations of the United States Coal & Coke Co. in McDowell County, West Virginia, are electrically operated from a central power station located at Gary. This company operates twelve plants, all but Nos. 1 and 2 being drift mines. Plants 1 to 8 have coke ovens, while plants 9 to 12 have none, these latter being designed for mining and loading coal only.

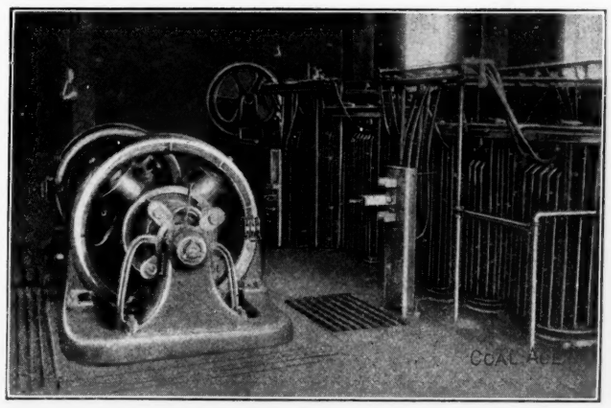
Electrical operation was gradually introduced, the first installation being made in 1902 and consisting of two 400-kw. generators, driven by direct-connected cross-compound engines. These furnished power for mine haulage, crushing, coke ovens, pumping, and fans. In the spring of 1904, one 750-kw., 6600-volt, engine-driven generator was added, this unit being duplicated in the spring of 1905. Power house facilities were further increased in the spring of 1907 by the purchase of two 1000-kw. turbines, one being high and the other low pressure, with complete condensing and cooling apparatus. This brought the power house capacity up to 3800 kw.

After three years of satisfactory experience with electrically operated machinery, it was decided to electrify mining operations, as regards mining machines. This was accompanied by the further installation of motor-driven air compressors, for lifting water from the deep wells.

Subsequently, electrically driven coke-drawing machines were installed to partially handle the coking processes at mines 1 to 8.

CAPACITY OF PLANT IN BOILER HORSEPOWER

The original boiler installation consisted of four 300-hp. Aultman-Taylor horizontal water-tube boilers. With the addition of power units, more boilers were installed until now, besides the four 300-hp. ones already mentioned, there are five 520-hp. boilers of the same type, making a total boiler capacity of 3800 hp., all of these being fired by Jones' underfeed stokers, which are supplied with coal from an overhead bin filled by a larry.



INTERIOR OF A SUBSTATION, SHOWING TRANSFORMERS, ROTARY, AND FAN MOTOR

Duplicate feedwater pumps and heaters have been installed.

Every piece of the apparatus at the entire twelve plants, with the exception of the hoisting engine and the fan at No. 1 shaft, is driven by electrical power from the central station.

The generators are all 6600-volt, 25-cycle, three-phase machines and electrical power is transmitted at this potential to all the substations except No. 12. For transmission to the latter, which is about 12 miles from the central station, the potential is stepped up to 23,000 volts by oil-cooled transformers installed in the power station. All the transmission lines are calculated for 5 per cent. line drop.

The main station switchboard consists of twenty panels, six of these controlling the generators, while there are eight feeder panels controlling the lines to the different

plants, 5 panels controlling motor-generator sets used as exciters, and a Tirrill regulator panel.

Rotaries of 150-kw. capacity have been installed in each of the substations, nine plants having one rotary and three 2 rotaries each. These rotaries supply direct current at 275 volts for the operation of locomotives, inside mining pumps, mining machines, etc., the power being taken from the locomotive trolley, thus making it unnecessary to run another line into the mines, and greatly simplifying the installation.

The substation switchboards consist of from three to seven panels to control rotary converters, step-down transformers for both power and lighting, and synchronous motors driving generators or fans.

The transmission lines are supported on wooden poles with the exception of the line from the power house to No. 6 works, where for a distance of 7000 ft., a heavy galvanized steel tower line has been constructed. This line now carries two separate circuits, one for Nos. 6 and 7 and the other for Nos. 8 and 9 mines, and provision has also been made for a third circuit to proposed plants on the waters of Dry Fork.

Location of Substations

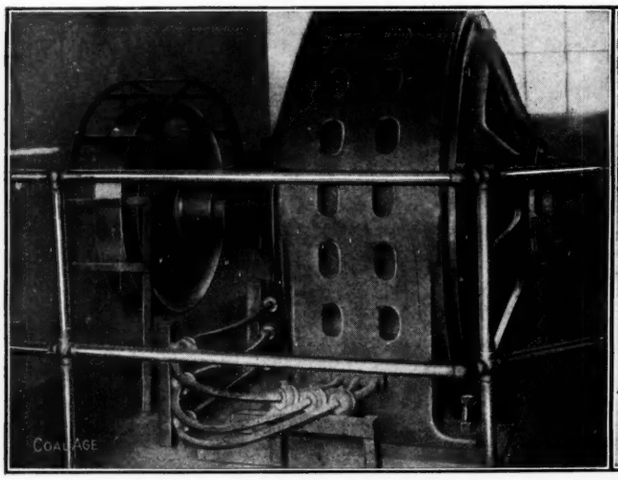
The substations are, for the most part, located at the pit mouths and, generally, the motors driving the mine fans are in this building. The power transformers for reducing the transmission potential to 440 volts for operation of the induction motors are located in these substations, although, at some works, it was found more economical to have the transformers nearer the tipples than the substations and they were installed accordingly in separate transformer houses. There are, in all, 87 single-phase transformers, having an aggregate rated capacity of 5745 kv.-a., which are used for power, and 27 of 400 kv.-a. total capacity used for lighting.

The transformer house switchboards consist of the necessary step-down transformers and out-going low voltage circuits for both power and lighting.

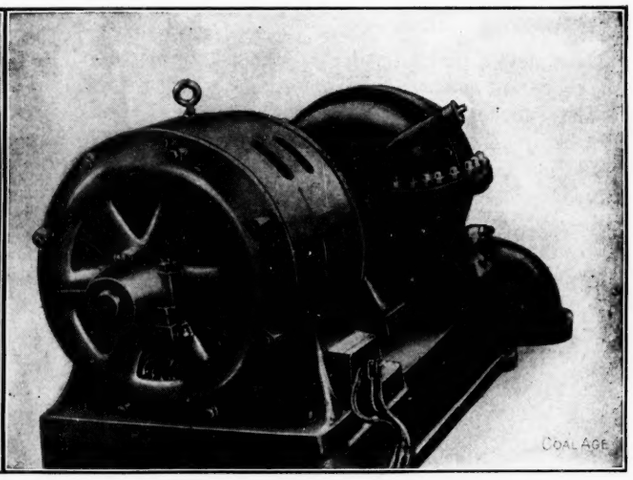
There are nine single and three double tipples, each of the latter receiving the product of two mines. At eight of the operations, steel tipples have been erected. All of the tipples are provided with Phillips automatic cross-over dumps and, in every case, the coal is discharged into a small hopper and from thence passed to the picking tables, all of which are 4 ft. wide, induction motor driven, and run at a speed of 50 ft. per min. The picking tables at all the coal plants, feed directly into a chute, from which the coal passes into the bins, while, at the coke plants, the coal is fed from the picking tables to chutes leading to the crushers and from thence it passes to bins.

At No. 2 mine, the dump is located at the foot of the slope, from which point an overlapping bucket conveyor, induction motor driven and working on a 40% incline, carries it about 260 ft. to the tipple. At No. 9 plant the difference in elevation between the two mines on opposite sides of the valley is so great that the coal from one is brought directly to the top of the tipple, while that from the other is lifted to the same elevation by a rubber belt conveyor 210 ft. long, working at an inclination of 28%. At No. 12 mine the coal is 600 ft. above the loading point, and about 1200 ft. horizontally from it, consequently, it was deemed best to locate the dump and picking tables at the top of the hill and to bring the coal down by three retarding conveyors, the first passing it to the second, the second to the third, while the third discharges it into the bin.

So satisfactory has been the electrical operation that individual drive by induction motors has been standardized for the operation of the tipples of this company, the picking tables requiring, on an average, a 9-hp. motor, while a 40- to 75-hp. motor is required to drive the conveyors from the mine, the power demands varying with the grade.



An Induction Motor Direct-Connected to a Fan through a Flexible Coupling



A Motor-Driven Centrifugal Pump for Domestic Water Supply

At first the crushers were belt driven, but so much trouble was experienced with bearings and belts that they are now driven by direct-connected induction motors through a flexible coupling.

There are 14 crushers driven by motors ranging in capacity from 75 hp. to 300 hp., the total load being 2525 hp.

The Water Supply

At all the coke plants, the water supply for the ovens is obtained from the river or from its branches on which the plants are located, the water being pumped

from the streams into large steel storage tanks, by direct-connected, induction motor-driven, centrifugal pumps, the latter operating against comparatively low heads, the maximum being 250 ft. All plants have an auxiliary deep-well supply, which is used during the dry months of the late summer and fall. These wells also furnish an abundant supply of pure drinking water. Three of the plants, Nos. 2, 4 and 5, have deep-well pumps of the plunger type, each being driven by a 40-hp. motor, but at all the others air lifts are used, the water being blown into small tanks, from which the centrifugal pumps draw their supply. At four of the plants, Nos. 1, 3, 10 and 11, sumps have been cut out of the solid rock for the ground and stream waters to collect in. At Nos. 9, 10, 11 and 12 works, the water supply is for domestic use only and so nothing but deep-well water is pumped.

For inside pumping, 220-volt direct-current motors are used receiving their power from the locomotive feeders.

There are seven air compressors driven by induction motors, four of the latter having a capacity of 85 hp., two a capacity of 40 hp., while the seventh is a 75-hp. motor. These compressors supply air at a pressure of 100 lb. for the water lifts, and to operate gates under coal bins.

Ventilation is accomplished by means of fans, all motor driven, except the one at No. 1 mine, which is direct connected to an engine. The fans at works Nos. 2, 3, 5, 6, 7 and 8, are belt driven by motors. The fan at No. 4 works is driven by a 400-kw., 6600-volt synchronous motor, direct connected by a flexible coupling. The fans at works 9 to 12 inclusive are direct driven by induction motors through flexible couplings. In most cases the motors are two-speed machines, and are run usually for four or five years at the lower speed before increased size of the mine demands the full capacity of the fan. The motors direct connected to fans have a capacity of 150 hp. at 120 r.p.m. and 300 hp. at 240 r.p.m.

Improving the Power Factor

To improve the power factor, which otherwise would be low, owing to the large induction-motor load, two 400-kw. synchronous motors were installed at plants Nos. 4 and 6 to drive fans, one by a flexible coupling and the other by a belt, about 200 hp. being required for this purpose, and the excess capacity supplying leading current to improve the power factor. A 500-kv.-a., 6600-volt, synchronous-motor, direct-current generator set has also been installed for its condenser effect upon the transmission line.

Although for many years coke was made in beehive ovens at eight of these plants, its production has now been discontinued, and the entire output of the mines is shipped to Gary (Indiana), Joliet, South Chicago and other points, where, mixed with other coals, it is coked in the more economic byproduct oven. Such equipment as electric-charging larries, coke-drawing machines, etc., used in this process has, therefore, been disposed of.

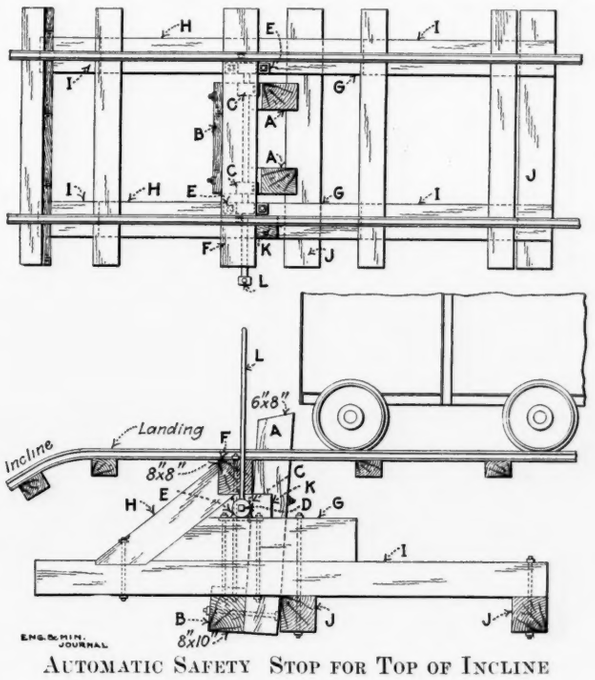
Motor-driven coal cutters are employed almost exclusively, there being 78 Sullivan machines, and eight Jeffrey short-wall machines each driven by a 30-hp., 250-volt, direct-current vertical-shaft motor, while, for a few low-vein machines, horizontal-shaft motors are used.

Gathering in these mines is performed mostly with mules. There are thirty 13-ton and eight 7½-ton, 250-volt locomotives for mine haulage.

The ratio of direct-current motors to direct-current generator capacity is 232%, while the ratio of all motors to generator capacity is 277%, and the load factor of the central plant is 30% with a total motor load of 16,000 hp. The consumption of electric power per month is approximately 1,200,000 kw.-hr., while the coal production is 15,000 tons per day.

Safety Block for Inclines

To prevent the accidental return of a car or skip that has been hoisted to the top of an incline and detached, the device shown in the accompanying drawing is recommended by William W. Jones, state mine inspector, Albany, N. Y. It consists, says the *Engineering and Mining Journal,* of two almost upright timbers *A,* fastened to the square shaft *D* by the straps *C*. The shaft is turned in two places to fit the boxes *E*. The bottoms of the timbers *A* are bolted to a transverse piece *B*. The hoisted car hits the timbers *A,* which revolve with the shaft, permitting the car to pass. The weight of *B* then brings them to the upright position and the cross piece *F* prevents their swinging in the other direction.



Automatic Safety Stop for Top of Incline

BILL OF MATERIALS FOR SAFETY BLOCK; TRACK 3-FT. GAGE

Timber	Iron
A 2 pieces 6x8 in.x4 ft. 4 in.	4 bolts ½x20 in.
B 1 picee 8x10 in.x2 ft. 2 in.	2 bolts ⅝x14 in.
F 1 piece 8x8 in.x5 ft.	2 bolts ⅝x17 in.
G 2 picese 8x10 in.x4 ft.	2 bolts ⅝x28 in.
H 2 pieces 8x8 in.x3 ft. 2 in.	2 bolts ⅝x34 in.
I 2 pieces 8x8 in.x10 ft.	4 bolts ½x10 in.
J 2 pieces 8x8 in.x5 ft.	2 bolts ½x18 in.
K 1 piece 5x6 in.x1 ft. 1 in.	1 shaft 1 15/16x1 15/16 in.x4 ft. 4 in.
	1 piece ¾x1½ in.x5 ft.
	2 clamps for shaft
	2 boxes 2 7/16x8x2 in. bore.

To permit a car to go over the head of the incline, the lever, which is attached to a square portion of the shaft, is used to tip the timbers over so far that they clear the car axles and permit the car to pass over them.

The New Brunswick man who built and lined his own coffin with asbestos must be reasonably certain where he is going.

CURRENT COAL LITERATURE

Does Coal Contain Living Organisms?

John Harger in his recent book on "Coal and the Prevention of Explosions and Mine Fires," says:

The occurrence in coal of such large quantities of methane practically free from other hydrocarbons is mysterious from a purely chemical point of view. Among the thousands of organic compounds which have been made in the laboratory, not one is known which spontaneously decomposes with the evolution of methane. Furthermore, no process is known, with the exception of the reactions between zinc methyl or aluminum carbide and water, by which methane, unmixed with other hydrocarbons or with hydrogen, can be prepared in the laboratory. For these and other reasons, I think it necessary to conclude, on purely chemical grounds, that the formation of methane in coal seams is due to bacterial fermentation.

Possibly the chief factor in the transition from decaying vegetation to anthracite is a constant fermentation. At the present time most geologists accept the bacterial theory for the first stage in the transition from vegetable matter to coal. Bernard Renault proved the existence of micrococci in the petrified state in some coals; he showed also that the tissues in some petrifactions show all the phenomena of cells attacked by bacteria.

E. Galle* found, in the course of a bacterial study of different kinds of coal under both anaerobic and aerobic conditions, that, out of seven kinds of bacteria isolated, four, when grown on suitable media in presence of coal, produced combustible gas mixtures containing from 71.5 to 84.8 per cent. of methane and from 5.4 to 27.3 per cent. of carbon dioxide. He showed that these combustible gas mixtures were generated by the bacteria even under conditions approaching those which prevail in nature.

*"Central Bakter a Parasiteuk," 1910, 28, 461-473; "Chem. Zeit.," 1911, 1. 48.

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Karns Reciprocating Heading Tunneler

By O. J. Grimes*

SYNOPSIS—The Karns tunneling machine consists of a drill head of diameter equal to that of the heading to be driven. This cutter is driven backward and forward, each stroke being seven inches long and each return being accompanied by a trifling rotation. Thus the machine breaks the rock into chips. It is said to advance from two to four feet per hour, and to operate at from one to five dollars per foot run.

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The latest idea in tunnel boring, the Karns tunneling machine, is operated similarly to the small air drill now used in drilling and blasting. It simply takes the place of the drill steel that goes into the chuck of the air drill except that it is heavier and must have a supporting carriage. The motion of the machine in operation is exactly the same as that of the small drill, the blows being delivered against the obstruction by direct forward motion. On the back stroke, the reciprocating parts turn slightly by means of a rotating device, similar to the rifle nut in the small drill, so that with each succeeding blow the cutting points strike the rock at a different place. The rock, instead of being ground into dust, falls down in small chips, resulting in more rapid progress.

Constructs a 6-ft. Circular Tunnel at One Operation

The latest and largest machine constructed has a cutting head 6 ft. in diameter. It is not a combination of individual drills, but is a single drill with innumerable points, striking simultaneously and rapidly.

*Snow Apartments, Salt Lake City, Utah.
Note—Extract from the "Engineering News" of Mar. 6, 1913.

There are 41 cutter blades made of tool steel, each 1 in. thick, 5 in. wide and of various lengths. Points like saw teeth are machined on one edge and the other edge is fastened in the face of the head. These cutter blades are set in grooves 1 in. deep and backed on one side by an extra inch, to resist the pressure of the cut rock at the bottom when the head is turning. They are held in these grooves by two hook bolts to each cutter, which pass through the head and hold them firmly in place.

To remove the cutters, the nuts on the hook bolts are unscrewed about 1 in., permitting the cutters to be pulled forward and slipped off the ends of the bolts. The entire set of cutters may be removed and replaced in about 2 hr. One set will drive from 25 to 75 ft. of tunnel, depending on the hardness of the rock, although 97 ft. have been driven without a change.

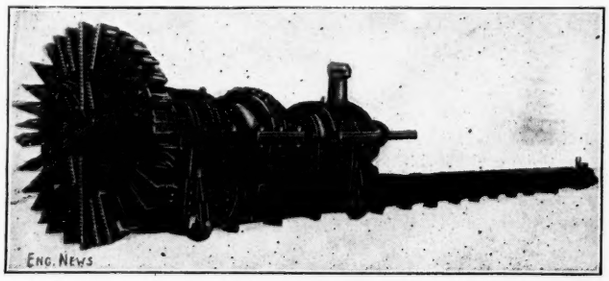


Fig. 1. Karns Tunneling Machine with Drill Head Measuring 6 Ft. in Diameter

Two to Four Feet of Progress per Hour

The reciprocating parts of this machine weigh 7¼

tons. This weight is thrown against the rock about 140 times a minute, each blow making a working stroke of 7 in., cutting from 2 to 4 ft. of tunnel per hour.

The cylinders are inclosed in a shell and connected to the supporting parts of the operating machine by heavy rods. The shell supporting the cylinders is held firmly in place by four columns, two in front and two in the rear, jacked to the top and bottom of the tunnel. The columns, shell and machine are advanced simultaneously with each 6 ft. of tunnel driven. The weight of the machine rests on four wheels under the supporting carriage

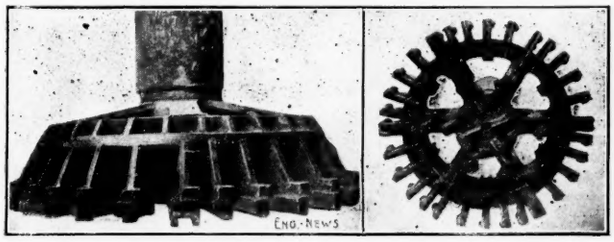


FIG. 2. VIEWS OF ROUGH CASTING FOR HEAD OF KARNS TUNNELING MACHINE

which run on heavy steel tracks on each side. These tracks are fastened to and move along with the carriage, eliminating the setting of tracks a second time.

ROTATES ON BALL BEARINGS

In the front cap of the machine are the front bearings, consisting of 48 steel balls, 3 in. in diameter, resting in 12 straight grooves, planed on the outside of the hub of the head casting. The other half of the grooves or bearings are on the inside of the heavy steel nut encircling the hub. The bearings at the back are under the rear cap and are similar to those in the front, except that there are but 8 races of 3-in. balls, three in each row.

The middle cap covers the rotating device. It is the same as the front and back bearing except that the races for the 3-in. balls are spiral. There are four races with three balls in each race. On the outside of the steel nut there are ratchet teeth with dogs to drop into them on the back stroke and hold the nut from turning. This compels the shaft within to turn, as the ball races are spiral. On the forward stroke the motion is reversed and the nut turns, the dogs simply sliding over the ratchet teeth on the nut.

HOW THE MACHINE IS MOVED FORWARD

Having been fed ahead 6 ft., the moving up of the shell and holding columns under the cylinders by the feed screw is a very simple matter and requires but a few minutes. There is a truck under the shell supported by four wide-tired wheels on the rock. To move up, the columns are unjacked and made free. Then by a worm gear the surface of the supporting truck is raised so that the entire weight of the shell and columns rests on the truck. This done, it is simply a matter of turning the feed screw which pulls all under the cylinders again. The surface of the truck is then lowered and the columns rest on the rock, the jacks at the top are tightened and all is ready for driving another 6 ft. of tunnel.

The engine driving this machine is a double, 9½-in., tandem cylinder, with an extreme stroke of 8¼ in.

To operate a machine of this size, 2000 cu.ft. of air per minute are required, but a plant capable of furnishing 3000 cu.ft. per minute is always installed. The purpose of this excess of capacity is to avoid working the compressor and boilers to their full rating, thus lengthening their lives and providing extra power should a long stretch of hard rock be encountered. In such cases the additional air is used and the machine operated more rapidly, delivering much harder blows, with the result that the average speed is maintained throughout the work. A boiler of about 400 hp. is necessary to operate an air compressor of the required capacity.

OPERATING EXPENSE

To operate the machine on each shift, one runner and helper, two muckers, one engineer and a fireman are necessary. A blacksmith and helper are required in one shift in three. The cost per foot to drive a tunnel with this machine ranges from $1 to $5, according to the rock and cost of fuel and labor at the place of installation.

Tunnels of large size can be driven quickly, safely and cheaply. If a round tunnel 18 ft. in diameter is desired, a heading 6 ft. in diameter may be driven through the

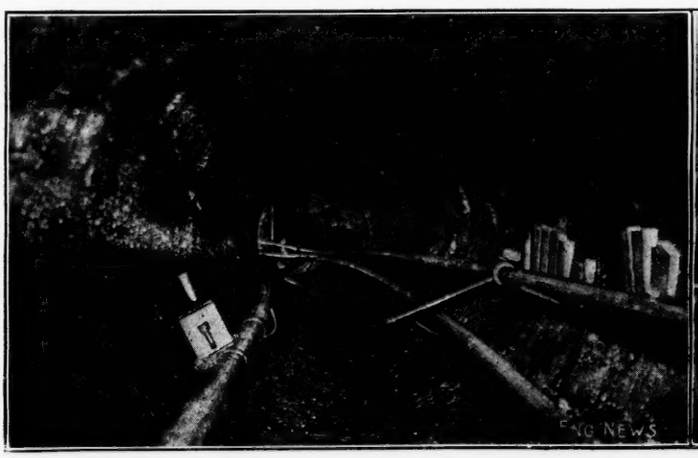


FIG. 3. A 6-FT. DIAMETER HEADING, ON A 10-DEG. CURVE DRIVEN WITH THE KARNS MACHINE

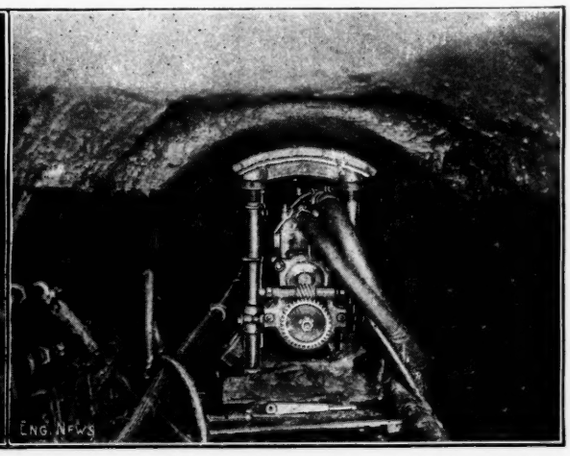


FIG. 4. REAR VIEW OF KARNS MACHINE IN JOHNSTOWN, PENN., TUNNEL

center, and from it holes drilled 6 ft. deep in a circle with a small air drill. When blasting, the tunnel will be broken the full 18 ft. In enlarging, the rock will be shot into the tunnel, where there is sufficient room for handling the débris.

It was the idea of the late David H. Moffat to use a Karns machine to drive the gigantic tunnel through the divide on the line of his railroad, the Denver, Northwestern & Pacific. He went so far as to have a model 18 ft. in diameter constructed, but his untimely death halted all preparations.

Used in both Coal and Granite

The tests to which the Karns machines have been subjected have been severe and practical. The first was made with a machine 52 in. in diameter through more than 100 ft. of solid granite near Boulder, Colo. The most recent demonstration was a tunnel 6 ft. in diameter and 200 ft. long, driven for the Valley Coal & Stone Co., near Johnstown, Penn. To show the adaptability of the machine to requirements, a 10° curve was driven as shown in the photograph.

The machine is controlled by the J. P. Karns Tunneling Machine Co., Mercantile Bank Building, Boulder, Colo. The inventor, J. P. Karns, president of the company, has offices in Citizens' Building, Cleveland, Ohio.

The Committee on Science and the Arts, of the Franklin Institute, Philadelphia, last year awarded the Edward Longstreth medal to Mr. Karns for his invention of the tunneling machine.

European Practice in Hydraulic Filling

By L. O. Kellogg*

Speaking before the New York Section of the American Institute of Mining Engineers, George S. Rice, chief mining engineer of the Bureau of Mines, described various methods of hydraulic filling in European collieries and potash mines. The filling of excavated parts of workings is becoming the standard method of support in Germany, Belgium and France and has been brought to a high state of development.

The character of material used depends on the relative accessibility of the possible sources of supply. Sand, crushed rock, loam and clay are used in varying proportions, and granulated slag is not uncommon. The manner of handling the material and the amount of water necessary varies with its character. Slag requires much water to move it, whereas clay moves easily but is slow to dry when placed and is unsuitable except in mixtures.

Natural sand or glacial drift is often handled through a rather elaborate series of screens and crushers. One plant stowing about 5000 cu.yd. of material per day dumps it from cars on a trestle, and flushes the dumped piles by hydraulic monitors (flushing nozzles).

In the potash fields, rock salt is used for a filling material. Large chambers are excavated in the rock-salt foot wall, and the broken salt stowed away in the workings, where the potash has been excavated.

The problem of suitable pipe for handling the water and material has received much attention. In Westphalia, porcelain-lined pipe is used, while in Upper Silesia, a steel pipe with a removable cast-iron trough-shaped bottom is finding favor.

As the method is practiced, there is no great saving in timber except in the quality; poorer classes of wood are permissible, since it does not have to stand up for any great length of time. The cost varies exceedingly, probably averaging somewhere between 20 and 30c. per cubic yard. Because of the higher cost of labor, this would be much increased in the United States, and a figure of from 30 to 40c. per cubic yard is given, tentatively when material can be obtained within two or three miles.

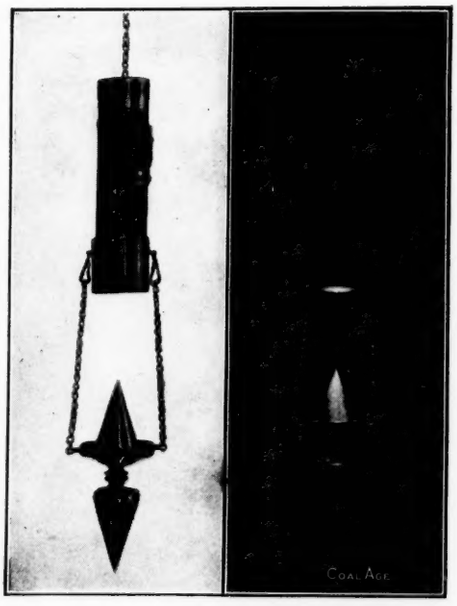
The use of the term "hydraulic stowing" is recommended for the purpose of designating the general process of flushing granular or fine material into mines to fill the excavations.

*Editorial staff, "Engineering and Mining Journal."

The Martin Plummet Lamp

Mining engineers will be interested in the following description of a plummet lamp recently invented by C. V. Martin, a mining engineer, of Zanesville, Ohio.

Every mining engineer and surveyor knows the difficulty in using safety lamps for fore- and back-sights where there is gas. Even when shielded carbide lamps, torches and reflectors are used, there are often many conditions in the work of the assistant that are trying to the transitman.



The Martin Plummet Lamp, Showing Its Appearance in the Dark

Two views of an improvement on the old methods are here given. One was taken in the outside light and the other by its own light as it hung from a spad in the mine. The illustrations are so plain that a description is hardly necessary. The device consists of a double plummet coupled and swung in gymbals by detachable chains from an electric cell lamp. The lamp has a sliding sleeve, to cover or expose the lens as occasion may require, and is fitted with a chain and hook for suspension from a spad. When not in use the entire device is conveniently carried in a leather case.

EDITORIALS

Metal Mining Accidents

We congratulate the Bureau of Mines on its work in collecting the statistics of metal-mining accidents and of the accidents occurring in mines producing nonmetals other than coal. A brief of these figures is contained in our sociological department.

There has been no public demand that this work should be done, because the mass of the people are interested only in great disasters affecting a large number of men at one time. An accident to an individual makes at best an unattractive headline and is relegated to those parts of the daily newspaper which contain advertising announcements. We fear that we would not have had a Bureau of Mines if it had not been for the Monongah, Naomi and Cheswick disasters. Even today the coal-mining division of that institution is the more popular and significant.

As we suspected, the returns diligently collected by Albert L. Fay for the bureau, show that the loss of life per man employed is higher than in the coal mines. The difference is actually about 12 per cent. And this is true, though there are no gas or coal-dust problems to be met and though 40 per cent. of the employees work in the open air, exposed to more easily avoidable dangers. The proportion of underground to outside workers in the bituminous mines of Pennsylvania is 17 per cent. and in the anthracite workings 28 per cent. It is obvious that all other things being equal, the coal-mining industry which exposes the larger number of men to the full risk would necessarily have the greater number of fatalities, should only equal care be taken.

It is unfortunately true that the metal-mining industry has not been conducted with the interest in safety which has marked the operations of collieries. This has not been because the metal industry has men of less liberal mold but because the general public, not being induced to consider the risks of metal mining by recurrent disasters of large proportion has never exercised so continuous a guardianship over the workers thus engaged.

The never wearying publicity which the coal operator has had to face has been irksome and expensive, but it has certainly been of great value and it has sustained admirably the hands of those who among the operating forces were disposed to regard the safety of the employee as one of the leading interests of the officers in charge of a mine.

The coal operator has to look back carefully if he would realize the progress he has made. Some 30 years ago, at the Long Valley coal mine, a mule driver was killed. As they brought his mangled body to the drift mouth, the foreman who till then had not heard of the accident strode up and blurted out "Was the mule hurt?" It was his first thought, and he narrowly escaped a lynching.

A few years ago, indeed, property was generally esteemed as more important than life as the anecdote of John Fulton at the Johnstown meet of the Coal Mining Institute of America last summer well illustrated. He stated that on one occasion when a man was killed by a vicious horse, the party in whose care it had been placed, remarked with considerable heat: "I don't care about your man Patsy; what I want to know is how I am going to explain the breaking of the buggy."

The loss of a life or the occurrence of an accident at a mine throws a dark shadow over the faces of all the officials. If a stranger happens to visit at the time, he is likely to receive but veiled hints of the misfortune, but if he once learns about it, there is no detail which is overlooked in describing it and it is likely that he will see the report to the inspector before he leaves.

We were interested in a recent article by Don D. Lescohier, of the Minnesota Bureau of Labor, in a recent issue of the *Survey*. He says:

"The key to the situation," said Michael Godfrey, general superintendent of the Canisteo iron district, "is the foreman. I hold my bosses responsible for every accident which occurs among their men. Their ability to prevent injuries and deaths is an important factor in determining promotion and an inability to prevent accidents is certain to result in their discharge. I have my foremen now where they come in and apologize for an accident. When the foreman is careful, the men have to be."

The point of view here stated is current wherever coal is being extracted. It comes as a shock that in the metal industry such a condition could be regarded as new.

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Fuel Well Conference

The glamour of time, the obtaining of a great name, and the possession of a stately plant are needed to enable the Bureau of Mines to fill the requisite place in the public eye. Until a new generation has sprung up, replacing the present, the bureau will be an innovation to be resisted by every body of older establishment. Every element of conservatism in the republic, and many of these there be, will oppose itself to this new force, beneficent but too new for full national acceptance. The recent gas- and oil-well conference showed conclusively that local pride and petty jealousies are preventing the bureau from doing the large work, of which it alone is capable.

When a federal bureau calls a conference on a matter of national importance, and asks for the opinion of the public on this matter, it is unseemly for the persons who are employed by the various states for the promotion of a healthy public sentiment and for the enforcement of the law relative to such matters, to hold coldly aloof and try vainly to kill the conference by abstention.

Credit must be given to Richard R. Hice, the state geologist of Pennsylvania, F. W. DeWolf, director of the State Geological Survey of Illinois, I. C. White, state geologist of West Virginia, and to no others of the state institutions for their coöperation in the work of inquiry.

If the authorities in the various states think the federal conference without them will not be able to effect

anything, they are much mistaken. It is probable that the well represented gas and oil men have succeeded in providing a law to their liking by recognizing the conference, and that the abstainers may find themselves mated in every later play.

The man on the street evaluates the force on the Bureau of Mines as of more authority than the local inspectorates and with reason. The decisions of the courts will also be molded greatly by what at least appears to be concurrent testimony of the highest value.

It was proposed, as we explained in our issue of Feb. 22, to give an equal representation to the Bureau of Mines, the gas interests, the oil men, the coal operators, state geologists and coal-mine inspectors. The scheme apparently went awry for want of the coöperation to which the bureau was fully entitled and instead a subcommittee was appointed consisting of three men: W. S. McCloy, of Pittsburgh, Penn., district superintendent of the Philadelphia Co., which has extended gas interests; E. B. Moore, chief engineer of the Consolidation Coal Co., of Fairmont, W. Va., who has had much practical experience in the effects of gas leakages from wells passing through coal beds, and O. P. Hood, chief mechanical engineer of the experimental station of the Bureau of Mines.

They produced an act which appeared in our issue of Mar. 22, and which we criticized in an editorial of equal date. This act reduced many of the suggested enactments of the bureau in many important ways, yet it is easy to realize that Mr. Hood could not feel disposed to present a minority report to the conference.

When the meeting was called to consider the report, the following persons attended, whose 21 names we quote at length:

Gas Interests—John B. Corrin, assistant general manager, Hope Natural Gas Co., Pittsburgh, Penn.; H. H. Davis, superintendent, Land Department, Greensboro Gas Co., Pittsburgh, Penn.; John Gates, attorney, Land Department, Philadelphia Co., Pittsburgh, Penn.; M. P. Layton, Manufacturers Light and Heat Co., Pittsburgh, Penn.; E. D. Leland, Philadelphia Co., Pittsburgh, Penn.; C. M. Thorp, attorney, Pittsburgh, Penn.; and Henry Wittmeyer, American Natural Gas Co., Pittsburgh, Penn.—7 representatives.

Oil Interests—A. F. Corwin, South Penn Oil Co., Pittsburgh, Penn.; E. E. Crocher, vice-president and general manager, South Penn Oil Co., Pittsburgh, Penn.; William C. Edwards, Parker & Edwards Oil Co., Pittsburgh, Penn.—3 representatives.

Coal Mining Interests—James Burns, mining engineer, Penn. Salt Mfg. Co., Natrona, Penn.; W. E. Fohl, mining engineer, Pittsburgh, Penn.; C. H. Jenkins, Hutchinson Coal Co., Fairmont, W. Va.; C. B. Britton, mine inspector, Moreland Coal Co., Pittsburgh, Penn.; E. J. Taylor, chief engineer, Pittsburgh Coal Co., Pittsburgh, Penn.—5 representatives.

Bureau of Mines Representatives—George S. Rice, chief mining engineer; O. P. Hood, chief mechanical engineer; A. G. Heggem, petroleum engineer, all of Pittsburgh, Penn.—3 representatives.

State Geologists—F. W. DeWolf, director State Geological Survey, Urbana, Ill.; Richard R. Hice, state geologist of Pennsylvania, Beaver, Penn.; I. C. White, state geologist of West Virginia, Morgantown, W. Va.—3 representatives.

State Coal Mine Inspectors—None.

Thus the fuel-well interests outnumbered the coal men 10 to 5 or 2 to 1, though the safeguarding of gas and oil wells is largely a matter for the man who drills them. It is his apparent interest to make drilling as cheap as possible. Thus the act, as now formulated, is practically written by the parties it is to control.

The views of the fuel-well interests as to the importance of the conference are made abundantly evident by the presence of several attorneys who attended the last session in the interest of the gas- and oil-well owners.

Though some of the bureau's suggestions were not accepted by the assembled fuel-well men, it cannot but be evident that the federal organization has done its duty. It has asked for a discussion and has not attempted to dictate legislation. It is hoped that its more liberal point of view will find imitators, for in all matters discussed for the first time, differences of opinion are sure to occur.

The Buried Valley near Scranton

The buried valley occupied by the Susquehanna and Lackawanna Rivers and Newport Creek between Glen Lyon and Jermyn constitutes one of the geologic wonders of America. The sand is deposited in places over 300 ft. deep and for three miles near Plymouth, its depth is over 200 ft. When we compare these figures with those of the falls of Niagara where the water is precipitated only from 154 to 164 ft. we begin to realize what changes would take place in the topography of the buried valley were all the sand removed and snugly packed into the coal excavations below.

We remarked last week that such a removal in whole or in part would create engineering difficulties at least equal to those it would remove and it is easy to see that though the railroads might be moved back to the rock slopes and might thus be protected, yet crossings from slope to slope would be made with extreme difficulty.

The silt, being pervious and the outlet afforded by the Susquehanna River too high to lower the water considerably all the excavations would be converted into lakes; in fact, most of the sand would have to be removed by deep-water dredges.

The acid character of the water in the deep lakes thus formed would make it a difficult matter to maintain any buckets and chains in operating condition and the amount of water which would seep into the workings below would make their drainage almost infeasible.

Moreover, as the silt below the upper level of the Susquehanna waters near Nanticoke would be filled with water, it is probable that almost as fast as the sand was excavated, other bodies of sand would travel in to take its place with unfortunate results to cities and villages resting on the silt thus drawn away.

In fact, as far as filling is concerned we advise the Scranton people to look in large part "to the hills from whence cometh their help," rather than to the easy digging sand lying in the adjacent valley. It would be easier to crush rock than to dig it under such undesirable conditions.

Accident at Baskett Mines

As we anticipated when we published the report from the Baskett mine of the Pittsburgh Coal Co., Henderson County, Ky., the affair was much exaggerated. We were careful to throw some doubt on the character of the news by the nature of the wording. Alexander Blair, the general superintendent, in answer to our inquiries states that a part of the casing in the shaft broke loose and until it was repaired the cage could not pass it. Most of the men left the mine by the air shaft and those who did not want to climb the ladders remained below till the shaft was in condition. All the men got out and the hoisting of the coal was resumed at 3 o'clock the same day.

SOCIOLOGICAL DEPARTMENT

The Home of the Frick Employee

By Thomas W. Dawson*

***SYNOPSIS**—A half a million dollars spent in two years have revolutionized the Frick villages, and the improvements cover, among others: 105 small stables, 295 chicken pens, 150 pig pens, 38 miles of picket fence, 2700 stone cellars, 465 front porches, 650 back porches, water supply within 1200 dwellings, 132 new houses, 1379 concrete cesspools, 2500 garbage receptacles, 6600 shade trees and 61.7 miles of surface drains.*

The H. C. Frick Coke Co. has spent during the last two years over one-half a million dollars in bettering the condition of the workman by improvements in sanitation and similar matters, and in making the home and its environments as comfortable as possible for the employee and his family.

Fig. 1. Model Alley at Standard, Mt. Pleasant, Penn.

Fig. 2. Street at Filbert, Penn.

It must be remembered that the majority of these employees are foreigners, many of them fresh from Europe. They are immediately encouraged in thrift and industry, and eventually become useful American citizens, much sooner than they would with environments not so elevating morally.

Unsightly Outbuildings Removed

One who visited the Connellsville coke region two years ago and returned to it today would be impressed at once with the wonderful transformation in the coke towns owned by the H. C. Frick Coke Co. Shacks or shanties which were standing on posts with unsanitary surroundings have been removed. At many of the towns whole rows of houses have either been replaced or moved to better locations. Nondescript outbuildings, built by the employee from all kinds of material, have been replaced by those of standard design and all these are neatly painted. The company built 105 stables, 295 chicken coops and 150 pig pens during the past year.

*Assistant chief engineer, H. C. Frick Coke Co., Scottdale, Penn.

Note—Abstract from paper entitled "Welfare, H. C. Frick Coke Co." read before the winter meeting of the Coal Mining Institute of America.

The houses of the company are better than the ordinary dwellings erected by corporations for their employees. They are built on substantial stone foundations, and neat and sanitary cellars are being provided, there being 2700 such cellars built to date, and practically every house is equipped with spacious front and back porches. The company built 465 of the former and 650 of the latter this year. All dwellings are well painted a durable red with white trimmings. Running water has been placed in the kitchens of some 1200 dwellings, or in about 18 per cent. of the houses owned by the company. A number of bath rooms have also been provided, and many of them are electrically lighted, as are also the streets where electricity is available for this purpose.

Paling Fences Provided

Every tenant is provided with a lot, of suitable size, neatly fenced. Recently the company has been abolishing the old style of board fence and has replaced it with neat and durable palings. The gates have self-closing hinges. The company has built 202,000 lineal feet, or about 38 miles of this picket fence in the past year, representing 19.7 per cent. of the total fencing at all the plants. Fences are whitewashed each year. This is done by the householder, lime being furnished free by the company, which insists on the work being done. The rent which is received for the larger houses is about $7 per month; smaller dwellings rent for less. Free coal is given the tenant if he conveys it from the mine to his home. In the remodeling of these towns, in order to improve their appearance and make them more satisfactory, 67 shanties and old dwellings have been removed, and 132 in addition to these were torn down but replaced by new, uptodate dwellings.

Sanitation of Villages

The company has been replacing the old unsanitary wooden privy vaults by neat concrete cesspools. There have been 1379 of these constructed, and the recent type constitutes 38 per cent. of the total number of vaults at all of the towns. Similar vaults are provided for the employees around the mine buildings at the plant. Combin-

ation closets and coal houses to the number of 800 have been built in the last two years, replacing the old unsanitary closet.

The company has furnished 2500 neat garbage receptacles, which are emptied each week, or as often as necessary. These are found at all the towns, and at all times workmen and carts can be seen cleaning up streets and alleys to keep them free from rubbish and in a sanitary condition. To beautify the towns, 6600 shade trees have been recently planted.

Surface-water Drainage

Streets and alleys are graded and suitable concrete and brick drains constructed. Concrete water channels have been built where a short time ago unsightly and unsanitary water courses existed. The construction of 61,000 lineal feet, or about 11½ miles of brick drains; 71,000 lineal feet, or about 13.5 miles of concrete curb drain, similar to that laid in towns and cities; and 182,000 lineal feet, or about 34.5 miles of concrete drains of various sizes, in the past two years, as well as about 12,000 lineal feet, or about 2.2 miles of the larger type of concrete drain, has provided a complete system of drainage for each town. Thus all the towns of the H. C. Frick Coke Co. are in a first-class sanitary condition.

Specifications of Drains in Fig. 3

Illustrations accompany this article, showing standard methods of constructing drains. The cross walls in concrete curbs and gutters are 4 in. thick and the full width of the section. They extend to the minimum depth shown and further, when necessary to secure a firm bearing. Brick cross walls are 8 in. thick. All are set at 30-ft. centers. Expansion joints occur every 40 ft. These are made by inserting ⅛-in. sheet metal and withdrawing it when the concrete has obtained its initial set.

The wire rope used in concrete drains are old ropes of ½- to ⅝-in. diameter. Rope larger than the latter size are unstranded till the desired size is obtained. The brick are laid in 1 : 2 cement mortar.

Specifications of Drains in Fig. 4

Where wedge drains are used, subject to excessive wear, the bricks are laid on edge, and in 1 : 2 cement mortar at places of greatest abrasion; the excavation for brick laid on edge in wedge drains is 2 in. deeper than shown in the details. The brick used are ordinary hard-burned red brick. The sub-base is of well tamped coke mixed with clay.

SECTION	CU. YD CONCRETE PER LIN. FT.
CHANNEL	0.111
SEGMENTAL	0.070
SEMI-CIRCULAR	0.075
CURB DRAIN	0.068
SHALLOW DRAIN	0.040

PARTS	INGREDIENTS PER CUBIC YARD	
1	UNIVERSAL PORTLAND CEMENT	1.6 BBL
1½	No 1 SLAG SAND	0.33 CU YD
1½	No 2 BANK SLAG SCREENINGS	0.33 CU YD
3	No 1 BANK SLAG	0.66 CU YD

NOTE: Above mixture is equivalent to 1:2:4

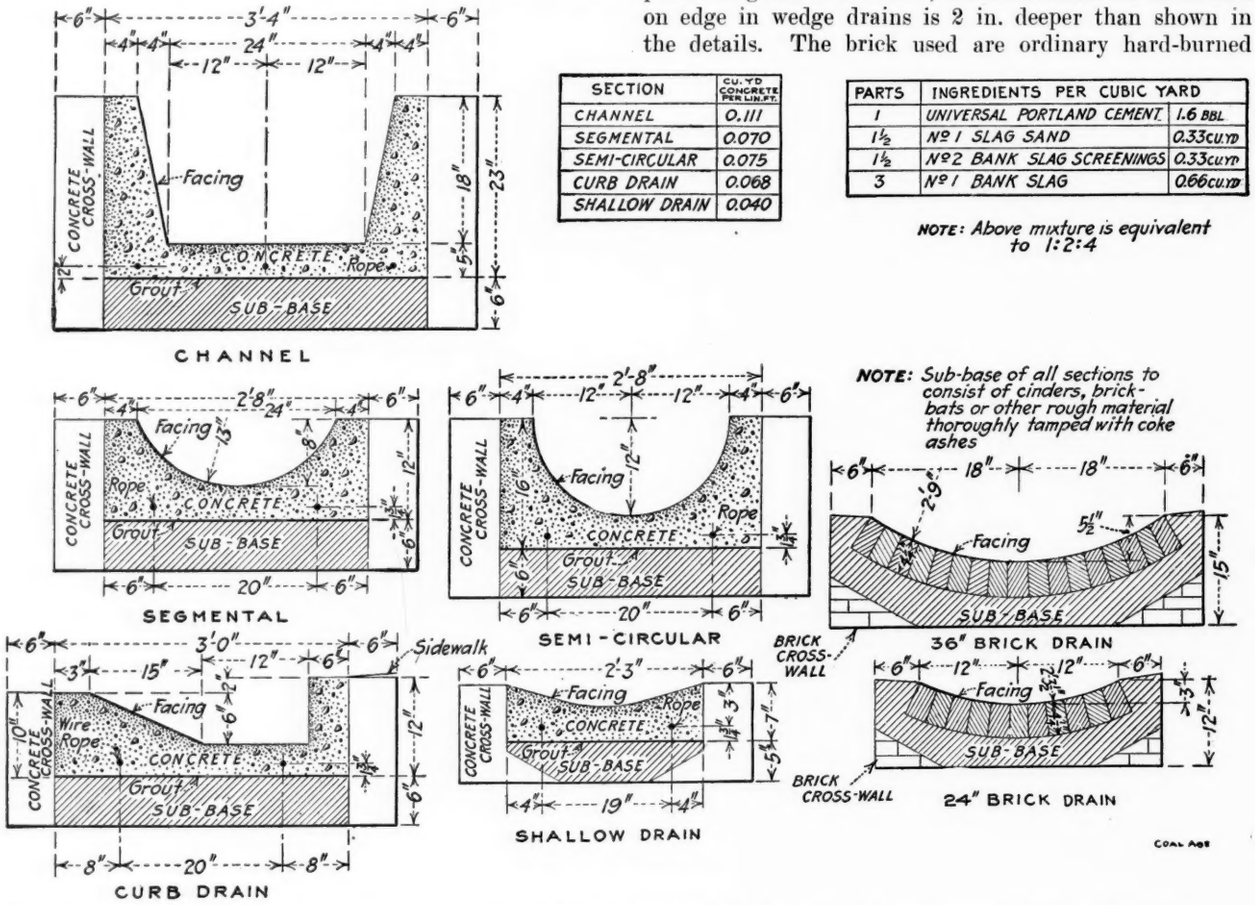

Fig. 3. Standard Sections of Drains of the H. C. Frick Coke Co. for Use in Their Mining Villages

Fully Organized Health Department

A sanitary inspector is on duty in each town, makes frequent inspection and gives instructions to the tenants to keep their houses and surroundings in such order as will insure the health of the community. Moreover the doctors in the various towns have been requested to make reports on the general health conditions, and steps are taken immediately to remove any menace to the public health.

An ample sewer system is also provided, consisting of underground and surface sewers. Thus the company has made it possible for its employees and their families to

live under conditions which are positively ideal and sanitary.

Bacteriological Analyses of Water Supply

It has been the company's aim to provide good, pure water, and make the surroundings at the source of supply such that the water cannot be contaminated. During the year, 788 bacteriological analyses were made of the water supply at the many towns of the company. Samples were taken from all the wells, springs, hydrants and reservoirs and from the water rings in the shafts. It was found that 72 sources of supply were unfit for use and these were made unapproachable. In addition, 88 sources which were in an unsanitary location were entirely closed, thus, in all, the communities were protected against 160 possible sources of disease. These analyses are made periodically to make sure that the water is not contaminated.

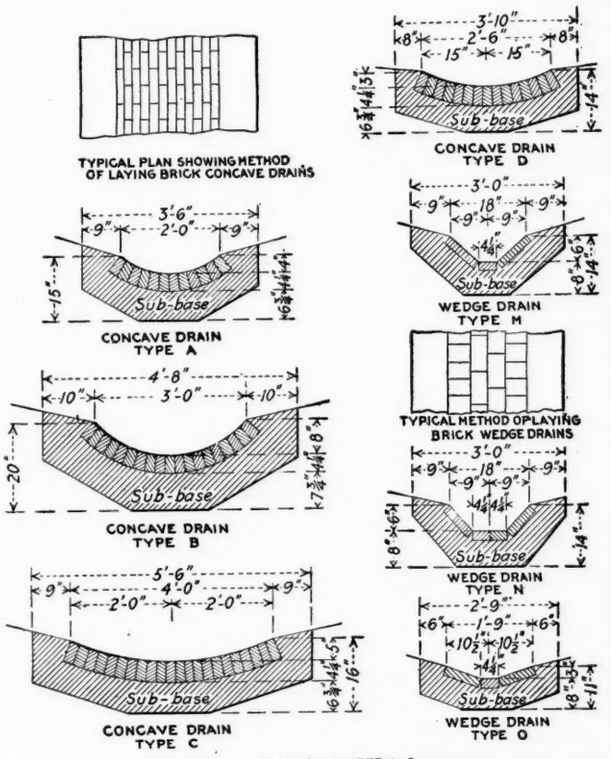
TYPICAL PLAN SHOWING METHOD OF LAYING BRICK CONCAVE DRAINS
CONCAVE DRAIN TYPE A
CONCAVE DRAIN TYPE B
CONCAVE DRAIN TYPE C
CONCAVE DRAIN TYPE D
WEDGE DRAIN TYPE M
TYPICAL METHOD OF LAYING BRICK WEDGE DRAINS
WEDGE DRAIN TYPE N
WEDGE DRAIN TYPE O
Sub-base
BILL OF MATERIALS
CONCAVE DRAINS
TYPE A - 12 Bricks per Lineal Foot
" B - 19 " " " "
" C - 22 " " " "
" D - 14 " " " "
WEDGE DRAINS (BRICKS LAID FLAT)
TYPE M - 7½ Bricks per Lineal Foot
" N - 9 " " " "
" O - 7½ " " " "
(BRICKS LAID ON EDGE)
" M - 15 Bricks per Lineal Foot
" N - 18 " " " "
" O - 15 " " " "
COAL AGE.

Fig. 4. Frick Standards for Brick Drains

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First Aid Competition at the Kentucky Mining Institute

The program committee of the Kentucky Mining Institute, for the meeting to be held May 16 and 17, has selected 24 events, given below, for the state-wide first-aid contest to be held on May 16 at Lexington, in connection with the spring meeting of the Kentucky Mining Institute, and the judges, on the day of the contest, will select five of the problems, and these five events will be performed by each team participating in the contest, and the prizes will be awarded upon the work performed in the problems so selected:

Event No. 1. Lacerated scalp; top of head with bleeding. One-man event.

Event No. 2. Right ear torn off; deep cut on chin; bleeding. Two-men event.

Event No. 3. Broken left arm below elbow. One-man event.

Event No. 4. Lacerated wound on left side of head (the temple). Lacerated wound on top of right shoulder. Two-men event.

Event No. 5. Wound of right eye; simple fracture of left knee cap; full-team event.

Event No. 6. Lacerated wound in palm of left hand. Right thigh, compound fracture; improvise stretcher. Full-team event.

Event No. 7. Treat burns of face, ears and hands. Two men carry patient without stretcher. Two-men event.

Event No. 8. Compound fracture of lower jaw on right side; deep wound on inner side of left ankle. Bright red blood. Full-team event.

Event No. 9. Left ear torn off; ends of fingers cut off right hand; bright red blood. Two-men event.

Event No. 10. Dislocated shoulder left side; right foot smashed, bleeding. Full-team event.

Event No. 11. Fracture right collar bone; lacerated wound of palm of right hand. Full-team event.

Event No. 12. Dislocation of right hip; leg thrown outward and broken left collar bone. Full-team event.

Event No. 13. Broken back; simple fracture of right forearm. Full-team event.

Event No. 14. Man fallen on electric wire, face down, clothing burning; treat burns of breast and arms. Full-team event.

Event No. 15. Fracture of right leg above the knee; carry the patient on a coat and pole stretcher and place in ambulance; mine at top of hill, hospital in the valley, road down hill all the way. Full-team event.

Event No. 16. Man overcome by gas in a four-foot seam with a dislocated left shoulder. Remove 30 ft. to fresh air. One-man event.

Event No. 17. Compound fracture of left leg below the knee; bone sticking out on the inside of the leg. Full-team event.

Event No. 18. Man overcome by gas; shoulder, lift and carry to place of safety. Perform standard form of artificial respiration. One-man event.

Event No. 19. Broken ribs on right side; dislocation of left shoulder. Full-team event.

Event No. 20. Man squeezed between mine cars; broken pelvis and left elbow badly crushed. Full-team event.

Event No. 21. Man overcome by afterdamp; burns on hands, arms, neck and face. Full-team event.

Event No. 22. Man found under fall of coal with punctured wound of abdomen; broken ribs on left side; cut on right side of face; bleeding with bright red blood in spurts. Full-team event.

Event No. 23. Man run over by motor found with right hand cut off. Left arm torn out of shoulder socket. Full-team event.

Event No. 24. Man fallen on electric wire; back down, unconscious. Rescue, give artificial respiration one minute; treat burns on back and right upper arm. Improvise stretchers. Carry 50 feet.

There will be a large number of teams from coal companies in the western, northeastern and southeastern coal-mining districts of Kentucky.

H. D. EASTON, Chairman.
HYWEL DAVIS,
W. L. MOSS.

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Kentucky Mining Institute

The annual meeting of the Kentucky Mining Institute will be held, May 16 and 17, at the College of Mines and Metallurgy of Kentucky State University, Lexington, Ky. The following papers will be read, with others not yet announced:

Workmen's Compensati n: K. U. Meguire, president, Snead & Meguire Coal Co., Louisville, Ky.

Welfare or Sociological Work: W. C. Tucker, general superintendent, Wisconsin Steel Co., Benham, Ky.

Coal & Mineral Taxation: Hywel Davies and W. H. Cunningham, president and secretary, Kentucky Coal Operators Association.

Mineral Development of Western Kentucky: Fluorspar District, C. S. Nunn, manager, Kentucky Fluorspar Co., Marion, Ky.

Mining Laws of Kentucky: C. F. Fraser, mining engineer, Taylor Coal Co. of Kentucky, Beaver Dam, Ky.

Calorimeter Tests Made on Kentucky Coals: A. M. Peter, chief chemist, Kentucky Experiment Station, Lexington, Ky.

How Best to Handle the Dusty Mine: David Victor, chief mine inspector, Consolidation Coal Co., Fairmont, W. Va.

A first-aid contest will be an attractive feature of the program.

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England's new coal-mines bill states that all newly opened coal mines shall have two main-intake airways, affording means of ingress and egress to the mine, one of which shall not be used for haulage purposes. Mines employing less than 100 men, or mines wet throughout, are exempt from this provision. Such mines are required to possess only two main airways, an intake and a return.

How Explosives Endanger the Miner's Home

By F. H. Gunsolus*

SYNOPSIS—There should be a storeroom for blasting powder, permissibles, caps and electric fuses at every mine. These dangerous explosives should not be taken home. The brightness of the caps attracts the eyes of the children and lures them to play with them. The use of permissibles and caps reduces fatalities in the mines and may increase the accidents in the home.

The subject of providing a house or storeroom in which miners can keep such powder as they have purchased but which they are not using, is of vital importance. This applies, particularly, to blasting powder. It is urged with reason that unless a storeroom is provided at the mines, the miners will have to take their powder to their homes, as the law does not permit them to take more than what is actually required into the mine.

A keg of blasting powder is not a particularly appropriate plaything for children, but how much more does this apply to blasting caps and electric fuses which are used by miners in places where permissible explosives and dynamite take the place of blasting powder.

Blasting Caps Are More Dangerous than Powder

The miner can, of course, gage the number of shots that he expects to make in one day closer than he can the exact number of pounds of powder or cartridges of Monobel, but he is less than human if he takes down into the mine the minimum number of detonators. As a matter of fact, he will usually allow himself several blasting caps more than he thinks he will need, and it is these blasting caps, when handled carelessly, which form a very decided menace to the health, happiness and prosperity of the community.

When the miner carries these articles loose in his pockets, they are apt to fall out or they may be removed by his wife when she puts his overalls in the wash. Being bright and attractive in color and outline, they excite the insatiable curiosity of youth to a much greater extent than the unattractive-looking powder.

The child may play with a small quantity of blasting powder without getting hurt, and it is unlikely that he would be able to drop a lighted match in a keg of powder, but it is the easiest thing in the world for a youngster to jab a pin or a nail in the open end of a blasting cap or to drop it into the kitchen stove, or hit it with a hammer, or do a number of other easily performed operations equally sure of disastrous results.

These blasting caps may be handled in the manner for which they were designed with practically no danger, but, on the other hand, they are exceedingly likely to explode if probed and a child is almost sure to lose several fingers, a hand or one or both eyes if he jabs a hat pin into the open end or holds a lighted match against it.

How the Permissible Explosives May Even Increase Fatalities

It is heartless and cruel, as well as shortsighted policy to contemplate these possibilities calmly. A child who has been blinded by a blasting cap, or has had a hand blown off, becomes a charge on the community and an expense to the tax-payer. Mine owners can ill afford to neglect their share in preventing these accidents after spending so much money in rendering the miner safe when at his place of work.

When the most progressive and enlightened mine owners go to enormous expense to reduce the number of accidents in their mines and the slogan of the entire industry is "Safety First," surely the prevention of the crippling and maiming of the children of their employees deserves instant consideration. There are over 600 accidents every year—practically all to children—due to the explosion of blasting caps and electric fuses. Unless some steps are taken to stop these articles from being carried home or thrown loosely into the pockets of the miners, this number is liable to increase, because more and more coal mines are abandoning the use of blasting powder and adopting the permissible explosives in order to promote safety.

Just imagine, for an instant, what a mine official would think if he saw his own youngster picking at the fulminate of a blasting cap with a hat pin to extract the explosive, so that the shell could be used as an ornament to a lead pencil. The picture of such an occurrence is not pleasant to contemplate. It is such an easy thing to prevent an occurrence like this, and it is so hard even to partially repair the damage, that no mine operator in his senses, appreciating the necessity for doing his share in preventing the maiming and crippling of children, should weigh for an instant, the trifling cost to him that is involved.

The miners, themselves, should, of course, be educated to do their part. It is not enough to provide a place where they can keep their powder and detonators when not in use, but they should also be warned of the danger of carrying these articles to their homes, and should be prevented, as far as it is possible to do so, from carrying blasting caps and electric fuses loose in their pockets and especially when they go home from the mine.

The Public Schools Will Assure the Safety of the Public

In some of the public schools in the large cities, children are taught how to avoid danger and it is explained to them in detail why they should not play on streets where traffic is heavy, why they should not coast in toy wagons on streets crossing others carrying heavy automobile traffic, why they should not hitch behind ice and other wagons, why they should look to the right on crossing the street until they get to the middle and then look to the left, and they are taught a number of other ways of taking care of themselves.

Would it not be fitting for the public-school teachers in the mining districts, to explain to the children, once in each session, at least, what a blasting cap is, how it is made, and what fearful things it sometimes will do to a child? It would seem that this instruction would be well worth the trouble involved.

*Manager, technical division, E. I. Du Pont de Nemours Powder Co., Wilmington, Del.

Fatality Rates Compared in Coal and Other Mines

An inquiry just completed by Albert H. Fay, mining engineer, of the United States Bureau of Mines, shows that fatal accidents in metal mines in the United States are more numerous in proportion to the number of men employed than are the fatalities in coal mines. Of the 165,979 employed in the metal mines in the United States during the calendar year 1911, 695 were killed, which represents a rate of 4.19 per 1000 men employed, as compared with 3.73 per 1000 for the coal mines of this country for the same period.

Fatality Rate in Metal Mines 12 per Cent. Higher Than in Coal Mines

The total number of fatalities, serious and slight injuries due to accident is as follows: Deaths 695, or 4.19 per 1000 men employed; serious injuries 4169, or 25.12 per 1000; and slight injuries 22,408, or 135.01 per 1000. Of the total number of fatalities, 532 occurred underground, or at the rate of 5.18 per 1000, and 153 were killed on the surface, or 2.49 per 1000.

The figures show that approximately two-thirds of the total deaths and injuries that occur in and about metal mines were caused as follows:

Of the fatal accidents, 32.52 per cent. are due to falls of ore or rock from roof, wall or bank; 11.23 per cent. to explosives; 15.39 per cent. to falling down stope, shaft or winze, and 5.32 per cent. to mine fires.

Of the serious accidents, 31.37 per cent. are due to falls of roof, wall or bank; 19.05 per cent. to car and haulage systems; 12.19 per cent. to machinery, and 6.41 per cent. to timber and hand tools.

Of the slight accidents, 28.86 per cent. are due to falls of roof; 15.52 per cent. to car and haulage systems; 10.10 per cent. to machinery, and 8.02 per cent. to timber and hand tools.

Copper Mine Underground Fatality Rate 6.31 per Thousand

The figures for the copper mines show 396 operators employing 44,693 men, of whom 31,557 were employed underground and 13,136 on the surface. The total number of deaths and injuries due to accidents reported is as follows: Deaths, 238, or 5.33 per 1000 men employed; serious injuries, 1326, or 29.67 per 1000, and slight injuries 9016, or 201.73 per 1000. Of the total number of fatalities, 199 occurred underground, making this rate per 1000 men employed 6.31. The surface fatalities were 39, or 2.97 per 1000.

Iron Mines Kill 5.34 per Thousand Underground Employees

The figures for the iron mines show 207 iron-mine operators, who employed 45,953 men, of whom 25,461 were employed underground and 20,492 as surface men, including those engaged in steam-shovel work. The number of deaths and injuries resulting from accidents in these mines is as follows: Deaths 197, or 4.29 per 1000 men employed; serious injuries 2032, or 44.22 per 1000, and slight injuries 8690, or 188.3 per 1000. Of the total number of fatalities, 136 occurred underground, or 5.34 per 1000 men, and 61 employees were killed while engaged in surface work, making this rate 2.95 per 1000.

In Mississippi Valley Lead and Zinc Underground Workers Have Accident Death Rate of 3.46 per Thousand

The figures for the lead and zinc mines refer only to those in the Mississippi Valley. The lead and zinc mines of other states are grouped with miscellaneous metal mines on account of the difficulty of making a distinct classification, as lead and zinc occur in so many places as associated metals in silver ores, as, for instance, in the lead-silver mines of the Cœur d'Alene district, Idaho. The Mississippi Valley lead and zinc mines form a class by themselves and hence are easily segregated.

The statistics given embody the reports of 483 operators, employing 12,521 men, of whom 9247 are underground employees and 3274 surface men. The total number of deaths and injuries due to accidents is as follows: Killed 43, or 3.43 per 1000 men employed; serious injuries 177, or 14.14 per 1000; and slight injuries 1311, or 125 per 1000. Of the number of men killed, 32 fatalities occurred underground, making this rate 3.46 per 1000 men employed, while 11 men were killed on the surface, or 3.36 per 1000 men.

Fatality Rate at Other Metal Mines Is 3.95 per Thousand Underground

The figures for the miscellaneous metal mines show 3817 operators, employing 48,919 men, of whom 35,176 were underground and 13,743 surface men. The deaths and injuries due to accidents are as follows: Deaths 193, or 3.95 per 1000 men employed; serious injuries 540, or 11.04 per 1000; slight injuries 3078, or 62.92 per 1000. Of the total number of fatalities, 163 occurred underground, or 4.63 per 1000, and 30 on the surface, or 2.18 per 1000.

The rates of serious and slight injuries are low when compared with the iron and copper mines. This may be accounted for in part by reason of the fact that this group includes many prospectors and small mines, which keep no records. Fatal accidents impress themselves on the memory and are easily reported. The serious and slight injuries are soon forgotten if not recorded. Many of these mines are in states where there is no inspection, and they are not required to keep accident records. Many of the larger companies operating gold and silver and lead-silver mines of the West have, for their own protection, hospital service and medical aid for their employees.

Non-metal Mines Are Comparatively Safe

The non-metal mines employed 13,893 men, of whom 3182 were employed underground and 10,711 on the surface. The total number of deaths and injuries due to accidents reported is as follows: Deaths 24, or 1.73 per 1000 men employed; serious injuries 94, or 6.77 per 1000, and slight injuries 313, or 22.53 per 1000. When compared with the copper and iron mines, these ratios seem exceedingly low. Judging from the reports received, this is largely accounted for by the fact that the mines, being small and employing an average of only 42 men each, do not keep complete records. The majority of these mines are in states where there are no state inspectors, and are therefore not obliged to keep accident records and make reports thereon.

The statistics have been published in Technical Paper No. 40. Copies may be obtained by addressing the Director, Bureau of Mines, Washington, D. C.

DISCUSSION BY READERS

Post Timbering at the Working Face

Letter No. 8—I believe in systematic timbering, to a certain extent; but I do not think it would be advisable for the state to pass a law specifying the exact distance that timber should be kept up to the face. Neither do I think it would be possible for the state mine inspectors, to specify the distance the props should be set apart and away from the face, in each seam and at each mine.

While mine inspectors, almost without exception, are practical and experienced men and know the nature of the roof in the different mines they visit, yet in some cases to employ one or two timbermen would be both practical and economical, particularly in view of the many ignorant miners that are now employed. In pillar workings, for instance, it is not economical or well to fill the places with props, especially where these are not taken out, as the pillars are drawn back. At the same time, it would not be safe to go into a place and tell the men they are standing too many props. I have actually seen men go into the gob and stand new props, because some of the old ones were broken under the weight. They actually thought they were doing a wonderful thing and it is often difficult to make them understand that the roof should fall in the waste, in order to relieve the great weight on the pillars.

A timberman, say in each district, would generally save far more than his wages by seeing that the props were properly set and that enough and not too many timbers were stood. How seldom do we go into a place and find the props stood just where we would stand them. They are often too far away from the face, or too far apart. Sometimes, a man anxious to please the boss will stand his timbers so near the face that he cannot work. At times, the props will be set within a foot of the rib where under a good roof they can do no good.

It may not be generally known, but in Durham (England) the deputies (firebosses) set all the timbers, in the face. Each deputy has from 15 to 20 men to look after, and an accident from a fall of roof or coal is a rare occurrence. Of course, the men know enough to stand a prop to keep themselves safe, but it is only stood temporarily till the deputy gets around.

Accidents do not generally occur as frequently under a bad roof, as where the roof is fairly good, because the men are apt to trust a good roof too far. To illustrate this, we were drawing pillars where the roof was short and friable, about halfway up the rooms. Though the miners working there were good careful men we were anxious till they got under good roof again and we thought then all danger was passed, but a few days later a man was killed there by a fall of roof.

Examining the place after the accident, we found the props within 5 ft. of the pillar end, and a piece of rock about 5 ft. across had fallen out and crushed the man's head. No doubt, the rock would sound solid enough when tested, but it was loose. Any old miner can recall similar instances.

I often wonder why there is not more preserved (creosoted) timber used in this country. It lasts three or four times as long as ordinary timber. I have seen such timber still standing that I was told had been there 20 years. It was just as good as when first stood. No doubt it will cost a little more in the first place, but it is far cheaper in the end.

THOS. HOGARTH.

Heilwood, Penn.

Letter No. 9—One peculiar characteristic of the coal-mining industry is that, except in reference to purely mechanical features, no "hard and fast" rule can be given to overcome the various dangers that may arise from time to time. The greatest source of danger is the fall of roof and coal at the working face, which danger is usually met by some form of "posting."

While posting, however, is of prime importance, it is not the only consideration in maintaining a safe conditon of the working face. It is equally essential that the development of the mine and the extraction of the coal should proceed in a systematic manner. In coal mining, as in every other industry, systematic work cannot be effective unless applied to all departments alike. The timber supply must be of uniform size and quality, and the timbers must be delivered promptly at the working face where they are required.

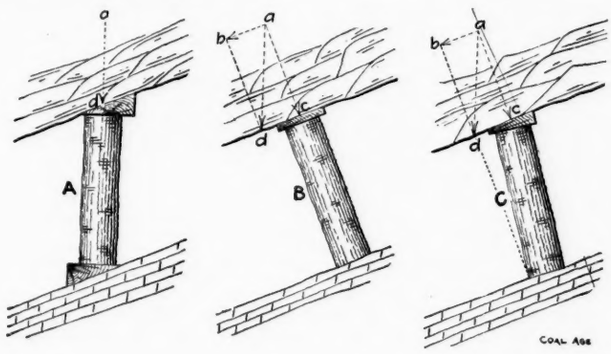
Posts are generally employed for three purposes, or to fulfill three conditions: 1. To make secure a bad and irregular condition of the roof. 2. To give warning of any movement in the roof strata or unsafe condition of the same. 3. To lend support to the roof strata over the opening and assist in the equal distribution of the load on the pillars. Each of these cases may be considered separately.

Before attempting to timber a particularly bad condition in the roof, or a bad piece of top, the place should be thoroughly examined to determine exactly its dangerous character. The person making the examination knows better where and how the several post timbers should be placed. I would not advocate the posting of a working place by men especially employed for that purpose. I believe greater safety can be secured by each miner timbering his own place under the instructions of a competent mine official, as this will make the miner himself responsible for his own safety and amenable to the mine regulations and discipline.

Under the present bituminous-mine law of Pennsylvania (Art. 4, Sec. 10), the foreman or his assistant must visit each working place "once each day while the employees are at work." In addition to this, in gaseous mines, the law requires (Art. 5) that each working place in the mine shall be examined twice each day, once before the men begin work and again during working hours. These several examinations of each working place should afford sufficient opportunity to give every miner the instruction he needs. My theory is that any ignorance on the part of the miner is best combated and overcome by careful inspection and patient instruction.

I consider the following points essential in post timbering: 1. In a level seam, a single post should be stood in a vertical position. 2. If the post is required for the support of the roof strata, it should not be wedged tight; and, in many cases where the roof or floor is hard, it will be necessary to set the post on a soft foot-piece, or a mound of dirt. In this case, the post should be twisted backward and forward to give it a solid bearing. 3. A cap-piece should always be placed above the post. 4. My personal preference is to stand the post with the large end down, as it grew in nature. The number of posts to be stood in a place and their arrangement, the distance apart, and the distance of the posts from the face of the coal, must be determined by the conditions in each place. My experience is that the use of long, heavy caps, or of crossbars, at the working face, will generally reduce the number of posts required.

I consider it generally a dangerous practice to set the first timbers so far from the face of the coal that the miner is unprotected. Under many conditions of the roof, it would be dangerous for the miner to be obliged to work between the posts and the face of the coal. Many accidents have resulted from this practice. Under particularly bad roof, places should be driven narrow and crossbarred. It may be often necessary to hitch the crossbars into the face of the coal, in order to give the miner the necessary protection.



SHOWING THE RIGHT AND WRONG WAY OF SETTING POSTS IN STEEPLY INCLINED SEAMS

The use of posts for the second purpose mentioned; namely, to give the miner warning of any movement of the roof strata and enable him to escape the danger that threatens, arises in pillar work. When used for this purpose, the posts should be wedged tight, so that they will nip and crack upon the first movement of the roof. In neither of these first two cases can any regular system of setting posts be adopted. The arrangement must always be what the conditions require.

A systematic method of timbering can be adopted with advantage when, as stated in the third case, the purpose of setting posts is to lend support to the roof strata above the opening and distribute the pressure of the overburden evenly on the pillars. In this case, the system to be adopted must be determined by such conditions as the following: 1. The width of the opening. 2. The height of the coal. 3. The nature of the roof and floor. 4. The thickness of the pillars. 5. The location of the road in the room or working place. A system once adopted should be followed closely as long as the conditions remain unchanged.

Posting in an inclined seam differs materially from that in a level seam. In a level seam, the action of the weight of the overburden is vertical or perpendicular to the seam. In an inclined seam of coal, the action of gravity is still vertical; but, owing to the inclination of the seam, the vertical force *ad* is resolved into two resultant forces, the one *ab* parallel and the other *ac* perpendicular to the seam. In this case, the post must resist the action perpendicular to the seam; and, for this reason, must be set more or less at right angles to the floor and roof.

Referring to the figure, it would be obviously wrong to set a post vertical, as at *A*, when the seam is inclined, as in that position it could not be properly fastened but would slip out of place. Neither would it be right to set the post as at *B*, perpendicular to the roof and floor, although that would be in line with the force *ac*. But, the post in an inclined seam must be set, as at *C*, leaning slightly up the pitch, from a normal position.

J. C. PARFITT.

Jerome, Penn.

Letter No. 10—In the mining of coal, in Pennsylvania, the conditions often require a better class of labor than is found in the mines. The majority of miners who apply for work are unfamiliar with the conditions and often untrained. Owing to these facts and since about one-half of the fatal accidents in coal mines are known to be the result of falls of roof or coal, the question of timbering at the working face, is exceedingly important. Owing to the general lack of experience on the part of miners, it might seem best to have the timbering at the working face done by regular timbermen, whose knowledge of the conditions and whose experience would enable them to do the work more efficiently than the miners themselves.

As a matter of fact, however, it is generally better to have the miner do his own timbering, if for no other reason than to avoid his working under dangerous conditions while waiting for the timbermen to appear. Not only should the miner be made to timber his own place, but he ought to be taught to follow a *regular system* that experience has taught is best adapted to the conditions in that particular mine.

Since a general method of timbering that is applicable to one mine may be quite unsuited for another mine, each mine ought to have its own carefully worked-out system, modified to suit its own conditions. There are at least two reasons for not following a regular system of timbering: (1) The roof may be strong enough to require no timber; and, in that case, it would be a waste to set posts where experience has shown they are not needed. (2) Under certain conditions, the miners may be so well trained in timbering, as to render a regular system unnecessary. This latter case, however, is not common.

A regular system of post timbering, however, may be said to have the following advantages: (1) The roof strata are often cut by irregular slips, fault-lines or clay seams. These may draw back from the coal face in such a way that the trouble is invisible to the miner and little danger is anticipated. Under these conditions, the miner is prone to give little attention to the timbering of his place and is often caught by a sudden fall of roof, the break occurring at the face of the coal. Under such conditions, a regular system of timbering is absolutely necessary in order to make the place secure. (2) In a regular system of timbering, posts are set more promptly and

greater safety is secured. A regular system of timbering eliminates the judgment of the miner, and any delay on his part in setting posts is readily observed and condemned. (3) A regular system of timbering affords better opportunity for a rapid examination by the mine officials and inspectors, who can observe at a glance whether the system is being properly maintained. (4) The roof pressure is more evenly distributed and the coal breaks better after mining. (5) The timber is recovered in better shape and not so many posts are left behind in the gob.

M. D. Cooper, Mining Engineer.
Ellsworth Collieries Co.
Ellsworth, Penn.

Sudden Collapse of Working Places

I have been an interested reader of Coal Age from its first issue. The recent discussion on the timbering of the working face gives me the opportunity to mention what I am inclined to believe is one of the most dangerous conditions with which we have to contend in the work of mining coal. I refer to the sudden collapse of a working place without any premonition that would give the miner a chance for his life.

My attention has been attracted to this danger very forcibly by the second occurrence of such a disaster in the Connellsville region, in the last two months. In the first instance, two men were in the place; one was the miner who worked the place and the other a visiting miner, from another portion of the mine. The visitor was caught and killed by the falling roof, after a race for life of about 30 ft. The accident occurred in the rib workings of the mine, where they were drawing back the pillars.

The method adopted for working out the pillars was what is known as a "split." The pillar was supposed to be 31 ft. wide; and a 7-ft. roadway was driven up the center of the pillar, leaving 12 ft. of coal on each side of the road. This road or "split" was about 31 ft. in length and double-timbered from the place of beginning to where it cut through to the goaf or waste. It was the finishing up of an 80-ft. rib that had been crosscut halfway. The original pillar had goaf on its left side (inby) and goaf in front.

Starting at the rear end, the miners had cut through to the goaf in front and had started to make a cut over to the goaf on the left side. They had only gone a distance of 6 ft., carrying a working face or breast 10 ft. wide. In this distance they had set two double-timber frames, at the time the accident occured. The fireboss had examined the place at 3 a.m. and again at 7 a.m. and reported the timbers in good shape. The mine foreman had examined the place again at 10 a.m. and the driver had just loaded a wagon of coal about 30 min. before the accident occurred, which was 11:30 a.m. All these men reported that the place was apparently safe and in good condition, no timbers being broken and there being no indication of a fall.

The miner who was working the place and who escaped said that the only warning they had was the breaking of a post. When the post broke, the miner called to the visitor, "Run!" and they both ran for their lives, the one who escaped being only about 4 ft. in advance of the other man.

The question that presents itself is: What caused this place to suddenly collapse, and is there any way in which the danger can be foreseen and the accident avoided. If good, sound timbers, well set, cannot be depended on to give sufficient warning to allow a miner to make his escape, then what method or what means can be adopted to insure the safety of the workers.

I should have mentioned that the coal was 9 ft. thick, with a tender roof, and about 500 ft. of cover overlaid the coal. I mentioned the place was double-timbered, by which I mean that it was timbered with 5-in. round timbers, forming a three-piece set (two legs and a collar). These frames were set 3 ft. apart and lagged overhead to support the roof between the timbers. Each set of timbers was tightly wedged over the posts and the lagging fitted in snugly. The bottom, or floor, under the posts was hard. When the fall occurred, the timbers were not broken, but thrown out faster than a man could run, for a distance of 30 feet.

I have tried to explain, in detail, the conditions that existed at the time and place of this accident, hoping that some readers may be able to explain the possible cause of the accident and suggest a remedy or means for its prevention.

The second accident of this nature occurred recently in another mine. I am not so familiar with the conditions surrounding this accident, but I am told that the collapse of the roof was so sudden the rib boss and the miner were both killed. There was certainly no indication of immediate danger, in this place, or the rib boss would surely have gone out and taken the miner out with him, which would be his duty if he thought the place was unsafe.

J. H. Lane, Mining Supt.,
Oliver & Snyder Steel Co., No. 3 plant, Uniontown, Penn.

Our Future in the Export Trade

I have read with interest what has been said in Coal Age lately concerning our future in the export business and admit the question has been treated in a masterly way. But, so far, we have not yet heard what the people who might buy American coal have to say about it. American coals are not so unknown abroad that foreigners have not had a chance to form an opinion in the matter.

As a matter of fact, the foreign buyer is acquainted with the analysis, the heating value and the physical qualities of our coals. I was astonished some months ago, at the amount of information on American coal that could be found in some buyers' offices in Paris. As you well know, Paris is a large coal-buying center not only for France, but Spain, Italy, and the whole Mediterranean littoral. All the French railroads also have their headquarters in Paris.

They all agree, in Paris, that we have coals in America that will enable us to compete successfully with any coal coming out of either England, Belgium or Germany. But they complain of our unwillingness or inability to deliver the coal prepared just as they want it and as they have been used to receive it from the English, Germans and Belgians. They also complain of our insisting on being paid against bill of lading when the time-honored Continental custom is ninety days. Even the French Government pays at 90 days.

As far as I was able to ascertain, while on the other side lately, the complaint was general about preparation. There was also a great deal of comment about irregularity in quality, some cargoes having been received which contained coals of widely different analysis. In the same cargo a coal containing less than 20 per cent. volatile matter might sometimes be found in one of the compartments, while coal from another compartment showed 32 per cent. volatile matter.

A cargo of 6200 tons was given as an example of such irregularity. It had been ordered by a French railroad as a sample cargo. The specifications called for a coal with not less than 30 per cent. volatile matters. When the ship reached Marseilles, the coal was inspected on the surface. It was plain that the shipment was made up of two different coals varying widely in looks. One was more lumpy than the other. The more lumpy one was less glossy than the other. Samples were taken and analyzed in the railway's local laboratory. From 18 per cent. in the smaller kind of coal to 37 per cent. in the more lumpy coal, was the difference in volatile matters.

At about the same time, a cargo of American coal intended for some gas works reached a Spanish port. Less than one-half of it was up to the guarantee in volatile matter. The rest of the shipment contained 20 per cent. volatile matter. The sellers had guaranteed a minimum of 32 per cent. These unfortunate affairs were made much of and advertised broadcast. It was even said, probably by competitors' agents, that this was only a fair sample of American business methods and explained why Americans demand payment against bill of lading.

Wide difference in volatile matters is accounted for probably by the fact that the shippers have mines in different seams. It also happens that when a shipper is unable to complete a cargo within the specified time, he gets another shipper to help him make the cargo. In either case, it is carelessness. As to preparation, of which foreign buyers also complain, it may be due either to poor preparation at the mines, or to rough dumping at tidewater.

But, no matter how well a coal is prepared at the mines, it is bound to suffer to a considerable extent when dumped by means of such arrangements as they have at all our tidewater piers, where the aim is fast work. Whether the coal is pulverized or not while being dumped, does not seem to be taken into consideration. English shippers know well they have little to fear from us as long as we continue to load our coals into sea-going ships in the way we do now.

F. C. CORNET,
Mining Engineer.

Charleston, W. Va.

Study Course in Coal Mining

BY J. T. BEARD

The Coal Age Pocket Book

THE ATMOSPHERE

The atmosphere is the aërial envelope surrounding the earth. The term is also used to describe the air or gaseous mixture filling any given space; as, for example, the mine atmosphere is the air and gases filling the mine or any portion of the workings.

Atmospheric Pressure—The weight of the air surrounding the earth causes a pressure, which decreases as the height above the surface increases; and the density of the air decreases in like manner, with the elevation above sea level.

Variation of Atmospheric Pressure—Atmospheric pressure varies irregularly with the condition of the atmosphere in respect to storms; the storm center being always an area of lower pressure than that surrounding the storm. In this country, a variation of 2 in. of mercury (say 1 lb. per sq.in.) in atmospheric pressure, in 48 hr., is not uncommon.

There is also a regular daily variation, the pressure attaining a maximum about 10 o'clock and a minimum at 4 o'clock, morning and evening. There is, likewise, a yearly variation, the general pressure reaching a maximum, in the northern hemisphere, in January and a minimum in July.

THE BAROMETER

The Mercurial Barometer—The pressure of the atmosphere is measured by the height of mercury column it will support against a vacuum. The mercurial barometer is a glass tube, about 36 in. long, closed at one end. This is first filled with mercury and then inverted, the open end being immersed in a basin of the same liquid, the mercury in the tube will fall to a height above the surface of that in the basin, such that the pressure of the atmosphere acting on the surface of the liquid in the basin will support.

Barometric Pressure—The pressure of the atmosphere expressed in inches of mercury is called the barometric pressure. For example, at sea level, the atmospheric pressure will commonly support 30 in. of mercury column; or is equivalent to a barometric pressure of 30 in.

Calculation of Barometric Pressure—One cubic inch of mercury (32° F.) weighs 0.49 lb . A barometric pressure of 30 in., therefore, indicates an atmospheric pressure of

$$0.49 \times 30 = 14.7 \text{ } lb. \text{ } per \text{ } sq.in.$$

which is the normal pressure at sea level.

Calculation of Water Column—The height of water column, in feet, the atmospheric pressure will support is found by multiplying the pressure (lb. per sq.in.) by 2.3; or dividing the same by 0.434. Or the barometric pressure, in inches, multiplied by one and one-eighth will give the equivalent water column, in feet. For example, at sea level,

$$14.7 \times 2.3 = 33.8, \textit{ say } 34 \textit{ ft.}$$

$$30 \times 1\tfrac{1}{8} = 33.75, \textit{ say } 34 \textit{ ft.}$$

The Coal Age Pocket Book

SPECIFIC GRAVITY

The specific gravity of a substance—solid, liquid, or gas—is the ratio of the weight of that substance to the weight of another substance taken as a standard, volume for volume;

$$Sp.gr. = \frac{wt. \text{ } of \text{ } unit \text{ } vol. \text{ } of \text{ } substance}{wt. \text{ } of \text{ } unit \text{ } vol. \text{ } of \text{ } standard}$$

Standard for Gases—The standard adopted for gases is air, of the same temperature and pressure as the gas.

Standard for Liquids and Solids—The standard adopted for liquids and solids is water at maximum density. Except where great accuracy is desired, the weight of 1 cu.ft. of water is taken as 62.5 lb. Exactly, 1 cu.ft. of pure water, at maximum density weighs 62.4283 lb.; or 1 cu.in. weighs 252.89 grains = 0.03613 lb.

Use of Specific Gravity—To find the weight of any volume of a substance, multiply the unit weight of the standard, by the specific gravity of the substance, and that product by the given volume; or, expressed as a formula,

$$Wt. = unit \text{ } weight \text{ } of \text{ } standard \times sp.gr. \times vol.$$

For example, taking the average specific gravity of anthracite coal as 1.5 the weight of this coal underlying 1 acre (43,560 sq.ft.) of land for a thickness in the seam of 1 ft.; or, as we say, per foot-acre, in long tons (2240 lb.) is

$$\frac{62.5 \times 1.5 \times 43{,}560}{2240} = 1823 \textit{ long tons}$$

Or, taking the weight of 1 cu.ft. of air (60° F., bar 30 in.) as 0.0766 lb., since the specific gravity of carbon dioxide (CO_2) is 1.529, the weight of 100 cu.ft. of this gas is

$$0.0766 \times 1.529 \times 100 = 11.712+ \textit{ lb.}$$

Calculation of the Specific Gravity of Gases—The specific gravity of a gas can be calculated by dividing one-half of its molecular weight by 14.4. For example, the molecular weight of carbon dioxide is 44; therefore, $44 \div 2 = 22$, and $22 \div 14.4 = 1.528$. The actual specific gravity is 1.529.

Finding Specific Gravity of Gases—A glass globe, any convenient size, is first weighed empty (air exhausted), w; then full of air, w_1; and, lastly, filled with the gas, w_2; the temperature and pressure remaining constant.

$$Sp.gr. = \frac{w_2 - w}{w_1 - w}$$

Finding Specific Gravity of Liquids—A glass-stoppered bottle is first weighed empty, w; then filled with water w_1; and, lastly, filled with the liquid, w_2. The specific gravity is then calculated by the above formula for gases. Or, the specific gravity is determined by a graduated float (hydrometer).

Finding Specific Gravity of Solids—Weight of the solid in air, w; weight immersed in water w_1. The weight of the water displaced is then $w - w_1$, which is the same volume as that of the solid.

$$Sp.gr. = \frac{w}{w - w_1}$$

EXAMINATION QUESTIONS

Ventilation

Ques.—What is meant by the "equivalent orifice," in fan ventilation?

Ans.—The term "equivalent orifice" is used to describe an opening in a thin plate, that will allow the given quantity of air to pass under the same pressure as is producing that quantity in the mine. The area of this opening is called the equivalent orifice of the mine. In the same way, the equivalent orifice of the fan is the area of opening through which the given volume of air would pass under the pressure absorbed by the fan.

Ques.—Explain the meaning of the term manometrical efficiency, as used in fan ventilation in estimating the efficiency of the fan.

Ans.—The term, manometrical efficiency, has been used to describe the ratio of the actual water gage produced by a fan at a given speed, to the theoretical water gage calculated by the formula

$$w.g. = \frac{1.2 \times 12}{1000} \times \frac{u^2}{g} = 0.0144 \times \frac{u^2}{g}$$

The above formula merely expresses the theoretical water gage, which it is assumed a fan whose tip speed is u will produce. It must be remembered, however, that the water gage produced is determined by the mine resistance and not by the fan. Cut off the mine, and there is no resistance or water gage. On the other hand, increase the mine resistance and the water gage is increased, for the same size and speed of fan. For this reason, the term manometric efficiency has no particular value, with respect to the fan alone.

Ques.—If 60,000 cu.ft. of air per min. is passing through an airway, under a pressure of 6.954 lb. per sq.ft., what will be the size of the opening in a regulator placed in this airway, to reduce the volume of air to 15,000 cu.ft. per min.?

Ans.—It is first necessary to find the natural pressure, or the pressure due to friction when 15,000 cu.ft. of air are passing in this airway. Since, for the same airway, the pressure varies as the square of the quantity of air in circulation, the pressure ratio is equal to the square of the quantity ratio. Calling the required pressure x, we have

$$\frac{x}{6.954} = \left(\frac{15{,}000}{60{,}000}\right)^2 = \left(\frac{1}{4}\right)^2 = \frac{1}{16}$$

$$x = \frac{6.954}{16} = 0.434 \; lb. \; per \; sq.ft.$$

The pressure due to the regulator is now found by subtracting this natural pressure from the original pressure, which is assumed to remain constant; thus, 6.954 — 0.434 = 6.52 lb. per sq.ft. The opening required in the regulator to pass 15,000 cu.ft. of air per min. under a ventilating pressure of 6.52 lb. per sq.ft. is then

$$A = \frac{0.0004\,Q}{\sqrt{w.g.}} = \frac{0.0004 \times 15{,}000}{\sqrt{6.52 \div 5.2}} = 5.35 \; sq.ft.$$

Ques.—A fan is 16 ft. in diameter and, running at a speed of 150 r.p.m., is passing 16,500 cu.ft. of air per min., under a water gage of 4 in. What is the equivalent orifice of the fan?

Ans.—First find the tip-speed u of the fan; thus,

$$u = \frac{3.1416 \times 16 \times 150}{60} = 125.66 \; ft. \; per \; sec.$$

The theoretical water gage of this fan at the given speed, is then

$$w.g. = 0.0144\,\frac{u^2}{g} = \frac{0.0144 \times 125.66^2}{32.15} = 7.07 \; in.$$

The manometric efficiency, under these conditions, is therefore

$$K = \frac{4 \times 100}{7.07} = 56.57 \; per \; cent.$$

Now find the equivalent orifice of the mine, thus

$$O_m = \frac{0.0004\,Q}{\sqrt{w.g.}} = \frac{0.0004 \times 16{,}500}{\sqrt{4}} = 3.3 \; sq.ft.$$

The equivalent orifice of the fan is then calculated by the formula

$$O_f = \sqrt{\frac{K}{1 - K}}\,O_m = \sqrt{\frac{0.5657}{0.4343}} \times 3.3 = 3.76 \; sq.ft.$$

Ques.—At a certain mine, there is installed a ventilating fan operated by an electric motor. The fan is producing 300,000 cu.ft. of air per minute, against a water gage of 4.2 in. The wattmeter registers 145 kw. for each of the two motors, or a total of 290 kw., in the fan house. At the power plant, one mile from the fan house, the meter registers 330 kw. What is the mechanical efficiency of the fan?

Ans.—The power lost in transmission is 330 — 290 = 40 kw.; or, 40 × 100 ÷ 330 = say, 12 per cent. of the power generated. At the fan house, it may be assumed that the efficiency of the motors is, say 95 per cent., which makes the power applied to the fan shaft, 0.95 × 290 = 275.5 kw.; or, 275.5 × 0.746 = 205.5 hp.

The horsepower on the air is

$$H = \frac{300{,}000 \times 4.2 \times 5.2}{33{,}000} = 198.5 \; hp.$$

According to these data, the mechanical efficiency of the fan is

$$\frac{198.5 \times 100}{205.5} = 96.5 \; per \; cent.$$

This is a very high efficiency for a ventilating fan. It may be that there were some factors assisting the ventilation in the mine that were unaccounted for, and that these operated to produce the high efficiency registered. It often happens, in conducting a fan test under mining conditions, that certain air columns, caused by the artificial heat of steam pipes in the shaft or slope, or the natural heat of the mine in dip workings, are powerful factors that must be considered in ascertaining the efficiency of the ventilator.

COAL AND COKE NEWS

Washington, D. C.

Under the present coal contracts made with the Isthmian Canal Commission, which have eighteen months to run from April, the present price of coal is about $4.09, plus the cost of discharging and other incidental items, the tidewater price being $2.70 and the transportation $1.39. The competitive price with the Government price will depend on the short haul from the United States, the proximity of supply to the canal and the means of getting it to the isthmus.

The efficiency of the uptodate vessels of the Government must be taken into consideration. It is understood that in the event of the free toll clause of the Panama act being repealed the Government may itself run a line of steamships through the Canal, which may act as a rate regulator against railway-owned steamship lines.

In this connection a memorandum recently issued by the Isthmian Canal Commission is of much significance as outlining the policy of the Government in regard to applications received from coal companies and fuel oil companies in reference to establishing private coal and oil depots on the Isthmus to supply shipping passing through the Panama Canal. The memorandum says, in part:

The act of Congress approved Aug. 24, 1912, authorized the establishment of Government plants for coal, fuel oil, etc., for supplying shipping, and steps are being actively taken to start the construction of the same. It is not, however, intended to prevent private interests doing business in the Canal Zone as regards selling coal and fuel oil to shipping.

Under the so called Taft agreement with Panama, coal and fuel oil may be brought into the Canal Zone by individuals and companies without the payment of duty to Panama.

It is estimated that oil can be, if required, transferred from one terminus of the canal to the other by pumping through a pipe line cheaper than by being carried across in oil vessels and paying canal tolls. Transportation of coal across the isthmus will probably be cheaper by vessel, including payment of tolls, than by railroad.

It will be the policy of the United States to retain complete control of the terminals, water frontage and transportation by land and water across the isthmus.

It will not be the policy of the United States to attempt to monopolize the fuel business, and every possible means will be taken to encourage the establishment of private coal and fuel-oil depots on the isthmus under proper conditions.

Under the conditions of a revocable license, it is doubtful whether an individual or company would be warranted from a business standpoint in making a large expenditure for dredging, wharf construction and similar improvements. From the standpoint of the canal, the duplication of such independent and separate improvements, the cost of which will have to be absorbed eventually by the selling price of coal and fuel oil, is not desirable whether suitable locations can be found and assigned for this purpose or not.

The Government plants are being laid out so as to afford ample wharf room and to provide ample modern coal-handling machinery for unloading colliers into the coal pile and reloading coal to lighters or barges. Likewise the Government fuel-oil plants will ultimately be combined with the Government coaling plants so far as wharfage is concerned. At Cristobal it is proposed to temporarily fit up docks 13 and 14, near the Cristobal dry-dock shops, with oil pipes and pumping plants in duplicate until the permanent combined coaling and oiling wharves are completed.

So far as coal is concerned, it has been decided to set aside a certain ground area that will be served by the coal-handling machinery with the same convenience as the area occupied by the Government coal pile for the storage of the different coal piles of individuals and companies.

This arrangement will obviate the necessity of any dredging, wharf construction, or purchase of coal-handling machinery by private owners and companies, and at the same time will enable them to obtain the benefits of the rapid coal-handling machinery to be purchased by the United States. It is expected that the Govrnment coaling plant will be in operation before Jan. 1, 1915. Suitable temporary arrangements will be made to take care of any business originating before the permanent plant is completed.

With the large number of coal and fuel-oil lighters and barges at each terminus of the canal that will be maintained by the United States, the purchase and use of additional barges and lighters by individuals and companies will probably be unnecessary, for the United States will be in a position to make a price on lightering coal for individuals and companies in its own lighters that will result to the advantage of all parties concerned.

Any taxes levied in connection with private coal and oil depots will have two purposes in view for the interests of the canal: First, to reduce the unnecessary duplication of plant; and, second, to encourage the carrying of large stocks of coal and oil. To accomplish this, there will be a tax based upon the cost of improvements which would enable revenue to be derived in proportion to the investment made, which will probably be 1 per cent. per annum on the cost of improvements.

Inasmuch as the storage of large amounts of coal and oil on the isthmus should be encouraged, a tax similar to the present merchandise tax would not be satisfactory, as it would tend to discourage same. In lieu of a merchandise tax, therefore, a tax of about one per cent. on the sales of coal and fuel oil by individuals and companies within the limits of the canal will be levied. This tax will probably be 1¼c. per barrel of oil, and 5c. per ton of coal of 2000 lb.

Report on Coal Prices

The full text of the report on anthracite coal prices prepared by the Department of Commerce and Labor as the result of a House resolution passed some months ago, has just became available. In brief the most important of the results are as follows:

The increase in wholesale prices, as measured by the net receipts from sales of anthracite coal by the operators since the agreement of May 20, 1912, amounted to an average of 25.82c. per ton, if the prices existing in June, July, August and September, 1911, are compared with the prices realized during the same months of 1912. On this basis of comparison the average increase in the price of sizes of coal prepared for domestic consumption amounted to 31.23c. per ton and the average increase on pea coal and the smaller steam sizes amounted to 16.14c. per ton.

This increase was in part due to the unusually active demand for coal in the summer of 1912 and cannot properly be assumed to be a permanent increase. It seems to consider as the probable permanent increase the advances in the circular prices asked for coal. A weighted calculation of the average increase in the circular prices of the Philadelphia & Reading Coal & Iron Co. for the prepared sizes of white-ash coal shows that the average increase at tidewater was 34.3c. per ton and on sales for railroad shipments 23.2c. per ton. The average for all sales (allowing 25 per cent. of the total shipments for tide water sales in accordance with the results of 1911) was 26c. per ton on the prepared sizes. No similar calculation can be made for the steam sizes, since no circular prices are ordinarily issued to cover steam sizes at tidewater and even when issued have little significance.

Furthermore, the discounts on prepared sizes of 50 and 40c. a ton customarily allowed in April and May, respectively, were suspended in April and May, 1912. As a result the operators gained not only by selling their prepared sizes of coal during these two months at 40 or 50c. more per ton than during the corresponding months of 1911, but, in addition, the purchasers, who were unable to secure their customary supply of coal during April and May, were forced to buy it either during June, July or August, when the regular discounts were smaller, or in September and the later months when the full circular prices are charged.

The coal companies in 1912 received through the general increase in prices and through the suspension of discounts about $13,450,000 more than they would have received for the same tonnage at the prices previously existing. Of this amount about $10,900,000 was derived from the general increases in prices, and about $2,550,000 from the suspension of April and May discounts. In addition, a limited number of operators received immense sums through the sale of coal at premiums made possible by the shortage of shipments.

These amounts, it should be understood, do not represent the amount of increases in net profits to the operators, because out of these increased receipts had to be paid the cost of the six weeks' cessation of work in April and May, and also the increase in the wages of employees resulting from the settlement of May 20.

The reasons presented by the anthracite operators for these increases in prices are that they were necessary to cover (a) the advance in the wages of their employees resulting from the agreement of May 20, 1912, and (b) the various increases in the costs of production which have taken place between 1902, the date of the last general increase in prices, and 1912, largely as a result of increasingly difficult physical conditions of mining, increases in taxes and more stringent mine laws.

The anthracite mine workers were benefited by the agreement of May 20, 1912, not only through a net increase in their wage rates, which averaged 5.6 per cent., but through the concession of certain working conditions which were considered of importance, though they cannot be measured in terms of money. An additional item of importance to the miners was the partial recognition of their organization, both in the negotiations and in the form in which the agreement was signed. The advance of 5.6 per cent. in mine-workers' wages represents an average increase of 9c. per ton in the cost of producing coal, and on the basis of the shipments from June to December, 1912, amounted in round numbers to $4,000,000.

PENNSYLVANIA

Anthracite

Scranton—Suit has been commenced by the Lackawanna Coal Co. against the People's Coal Co. to restrain the latter from continuing to mine coal at the Oxford colliery. The grounds given are that the defendant company has been mining outside the boundaries of its lease and, further, that it is mining recklessly. It is charged that the People's Company is taking out all the supporting pillars and that property in West Scranton is endangered.

Pottsville—Upward of 700 or 800 employees are on strike at the Philadelphia & Reading Coal & Iron Co.'s Otto colliery at Branchdale. Not a wheel is turning at the colliery and only those necessary to keep the fires and pumps going are on the job. The output is about 100 tons per day.

As a result of a mine accident, Mar. 20, at the Blackwood colliery three men were injured while working in the gangway. A loaded car was pushed up the incline and somehow or other it got away and jumped the track.

Wilkes-Barre—The Avondale Colliery of the D. L. & W. Coal Co., which has been closed since Feb. 25, was opened on Wednesday, Mar. 26. The colliery was closed down on account of a strike among the workmen, and remained closed until repairs had been made by the company.

Thirty members of the Industrial Workers of the World, employed at Jermyn & Co. collieries at Old Forge, were notified by the company that they must join the United Mine Workers or quit their jobs. They have been given three weeks to comply with this order. The company officials say they will not stand for two rival unions.

Carrolltown—The coal tipple of the Blaine Coal Co. has been destroyed by fire. The blaze caused a $13,000 loss. It is expected that the mine will be tied up for six weeks. Four hundred men are idle.

Du Bois—On Mar. 24, the mines of the North-Western Mining Exchange Co., a corporation, subsidiary to the Erie R.R., were still idle, and were commencing their sixth week of inactivity. It will be recalled that they quit work on Feb. 10 because the company refused to make the dump pan self-cleaning. After two weeks' idleness, the men returned to work on an agreement. After four days the company, ascertaining that it was getting short weight, closed down to change the pan. This suspension was to last three weeks. The company repaired the mine but did not work on the pan till last week.

Brockwayville—The F. A. Lane mine is worked out. In 40 years it has never had an accident, but its production at no time was much over 100 tons per day. For many years it had no railroad connections. There is another seam and the company expects to open it and dump the coal over the present tipple.

Punxsutawney—L. M. Furniss, state mine inspector, caused the arrest of seven foreign miners in Indiana County, charging them with neglecting to use sprags under their coal and failing to make a proper examination after a blast. They were brought before James A. Crossman, justice of the peace, and fined $1 and costs in each instance.

WEST VIRGINIA

Moundsville—One hundred and fifty miners spent the night of Mar. 20 in the mine of the Mound Coal Co. because of a breakdown in the shaft. The shutdown was caused by the dropping of the cage, which put the hoisting machinery out of commission. Since this shaft is the only entrance to the mine the men were forced to remain below until the necessary repairs could be made.

The Parrs Run Coal Co.'s mine was partially destroyed by fire, Mar 19. The loss will probably reach the $5000 mark, and is fully covered by insurance. Officials of the company state that it will probably be two months before the mine will again be put in operation. The cage fell a distance of over 400 ft. When the new cables arrive this will be raised and repaired. The mine employs about 100 men. Many of these have secured employment in the various mines of this section, but the remainder, in all probability, will be out of employment until the mine resumes.

Fairmont—Considerable damage was caused at the Middletown operations of the Consolidation Coal Co. when four company houses were destroyed by fire. The loss is estimated at about $7000. The houses were all insured and it is announced that they will be rebuilt at once. The fire was caused by sparks from a passing engine.

Charleston—Governor Hatfield has ordered the unconditional release of 10 of the 49 prisoners before the military commission. "Mother" Jones and other leaders were not released.

The Black Cat coal tipple, near Crown Hill, and a tipple at the Mahan mine on Paint Creek were burned Mar. 16. It is supposed that the fires were of incendiary origin.

KENTUCKY

Henderson—One hundred and thirty miners were imprisoned Mar. 18 in a coal mine of the Pittsburgh Coal Co. at Basketts because of a cave-in which clogged the mouth of the shaft. Reports state that there were no fatalities.

Louisville—A terrific wind storm passed over this city Friday, Mar. 2. The Consolidated Coal Co. suffered the loss of fourteen barges, tied up at Port Fulton, on the Ohio river near Louisville, which were blown loose and sunk by the storm. Each was loaded with 17,000 bushels of coal, worth about $10,000. The company also lost a pump boat valued at $2500. It may be possible to recover some of the coal by dredging, and perhaps to raise the barges. A number of other barges on the river were torn from their moorings, but were recovered without damage.

VIRGINIA

Norton—The Norton Coal Co.'s store in the coalfields which adjoin the Harlan and other eastern and southeastern Kentucky coalfields, was recently destroyed by a fire. The total loss was about $25,000, and of this only $8000 was covered by insurance. The coal company's store is to be rebuilt at once.

OHIO

Columbus—A bill has been introduced in the Ohio senate by Senator Moore of Jefferson County proposing to relieve a situation said to prevail extensively in mining sections of the state. The situation has to do with the instances wherein a farmer may have coal under his land, but finds himself completely surrounded by big interests that have bought up all the holdings. The farmer often finds himself unable to market his coal because of inability to get an outlet and thus is forced to sell his lands at a sacrifice. The Moore Bill would permit the owner of the land in such a circumstance, to condemn an outlet and pay for the appraised damages.

INDIANA

Brazil—Two hundred and fifty miners of Coal Bluff, together with sympathizers from surrounding towns attempted to mob John Beck, mine boss at the Monkey mine of the Clay County Block Coal Co. recently. Beck's alleged preference for Brazil miners is given as the cause of the outbreak.

Princeton—A temporary agreement has been made on the powder question at the Ft. Branch mine, where an explosion occurred recently. The state mine inspectors demanded that a new patent explosive be used instead of black powder. The company opposed the order and the mine was shut down. The new explosive is to be given a thirty-days' trial.

Dugger—Nine men were injured, four seriously, in an explosion of gas, Mar. 22, in Superior Mine No. 10. The mine belongs to the Vandalia Coal Co. Only 14 men were at work, cleaning up in preparation for opening again Monday. Usually there are 300 to 400 at work. The men injured suffered from burns and inhalation of flames and poisonous fumes. Two of them were taken to the hospital at Terre Haute.

ILLINOIS

Auburn—Two explosions in separate parts of the Solomon mine on Mar. 11 caused a serious injury to four miners. Officials of the mine are at a loss to find an explanation for the twin accidents, which occured a mile apart. The explosion extinguished the men's lamps and left them in the dark. It was some time before the rescuing party was able to locate the injured men and bring them to the surface.

OREGON

Portland—According to a newspaper article from Fossil, Ore., Anthony Mohr was at that place about a week ago and secured leases on coal lands wanted by the Pennsylvania Coal Co. The clipping from a Fossil newspaper says that Mr. Mohr is of the opinion that the fields he has leased are the most extensive in the West. The report also states that he has spent months in exploring them.

FOREIGN NEWS

A new company, of which Sir Owen Phillips, chairman of the Royal Mail Steam Packet Co. is a director, intends to establish a fueling station at Colon where the steamship company owns a pier, this property having been granted to it 60 years ago. The Packet Co. also owns an island not more than one hour's sail from Panama in the Pacific Ocean.

Bochum, Germany—A sudden fire broke out, Mar. 19, in the President colliery cutting off the superintendent of the mine and an unknown number of miners. The fire started close to the main shaft and spread rapidly. Gangs of rescuers found the dead body of the superintendent at the bottom of the shaft. Later in the day they brought out all the miners alive and unhurt.

London, Eng.—It is understood that on behalf of a powerful syndicate D. A. Thomas, chairman of the Cambrian Trust, will soon proceed to the United States in order to complete the negotiations for the purchase of coal mines there, which he entered into during his visit to several American coaling centers in January last. It is feared here that the opening of the Panama Canal will to some extent decrease the export movement from the United Kingdom, particularly from South Wales to ports on the west coast of North and South America, but by the acquisition of coal fields on the other side of the Atlantic Mr. Thomas and those associated with him will be in a position to secure a big share of the supply.

PERSONALS

D. A. Thomas has completed in South Wales, since his recent visit here, a combination of several collieries, capitalized at $10,000,000. These mines produce nearly four million tons, and the output will be increased to six million.

Arthur E. Nelson has been appointed district sales agent of the Consolidated Indiana Coal Co., with headquarters at 403 Traction Terminal Building, Indianapolis. Mr. Nelson is in general charge of the sale of the company's coal in the State of Indiana, vice Frank Ragan, resigned.

J. G. Smyth, manager of the Consolidation Coal Co.'s operations at Jenkins, Ky., has been appointed chief engineer and expects to leave for Fairmont, W. Va., to take up his new work. E. Drennen, who has been superintendent of the power and mechanical department, at Jenkins, will become manager.

J. W. White, engineering salesman for the Jeffrey Mfg. Co., located until recently at their Athens, Ohio, offices, has been transferred to Duluth, Minn. Mr. White will look after the sales work of the above company in eastern Minnesota, northern Wisconsin, and the entire Upper Peninsula of Michigan. His headquarters will be 1905 East Superior St., Duluth, Minn.

CONSTRUCTION NEWS

Pottsville, Penn.—The Locust Mountain Coal Co. has awarded the contract for the erection of a new breaker.

Birmingham, Ala.—The Tennessee Coal, Iron & R.R. Co. has made an appropriation of $100,000 for the opening of a new coal mine near Blocton.

Punxsutawney, Penn.—The coming summer will see the work of building two hundred new coke ovens at Sykesville by the Cascade Coal & Coke Co. completed.

Erie, Penn.—The Pennsylvania R.R. Co. will build a dry dock, coal and ore docks and track extensions at the harbor of Erie. It is said that these improvements will cost in the neighborhood of $1,000,000.

Duluth, Minn.—The fourth immense coal dock to be constructed in Duluth will be erected this summer by the Berwind Coal Co., at a cost of $500,000. The dock will have a storage capacity for about 500,000 tons of coal.

Pittsburgh, Penn.—The Erie & Northern R.R., of Ontario, Canada, is perfecting plans for a new and more direct route for bituminous coal into the Canadian markets. New lines of car ferries from Erie, Penn., to the north shore of Lake Erie are planned.

Uniontown, Penn.—The W. Harry Brown Coke Co. is arranging for the erection of several hundred ovens on the Weltner farm, just opposite Masontown in Greene County. Some six weeks ago the Brown company purchased about 1000 acres of coal from J. V. Thompson.

Ager, Calif.—The Yreka Development Co. is proceeding systematically with the work of opening up its vast field of lignite coal near here. The company has 3000 acres of coal beds. J. E. Gamble, general manager, is prospecting the whole area thoroughly. W. W. Barham is president of the company.

Johnstown, Penn.—The Atlantic Coal Co., which has extensive operations in the Boswell field, is sinking test holes in an entirely new field in Black township and it is expected will start a new operation this year. Wilson Creek branch of the Baltimore & Ohio R.R. is to be extended into the territory that will be developed.

Lima, Ohio—Ground has been broken for the erection of a modern $25,000 coaling station for the Lake Erie & Western R.R. The work of completion will be pushed with all possible rapidity and will be completed not later than Sept. 1. Only steel and concrete will be used in the construction work. Steam hoisting engines will be installed.

Cincinnati, Ohio—A syndicate headed by John B. Farwell, of Chicago, is to build a railroad between Tucumcari, N. M., and Rotan, Tex., with a branch line to the Dawson coal fields in New Mexico. Ohio and Pennsylvania coal men and capitalists are interested in the project and have bought up more than one million acres of land in western Texas.

Tamaqua, Penn.—The Kaska William colliery of the Alliance Coal Co., has closed down for extensive repairs both inside and out. It is expected that these will require about a month to complete. The improvements which have been under way at this colliery are progressing satisfactorily and within a short time the output will be greatly increased.

Huntington, W. Va.—Work on the Beaver Creek extension of the Big Sandy division of the Chesapeake & Ohio railroad must begin not later than Apr. 1 under the terms of a contract entered into by the Chesapeake & Ohio with the Beaver Creek Consolidated Coal Co., before the holdings of that corporation were taken over by the Elkhorn Fuel Co.

Pittsburgh, Penn.—The Miller Construction Co. has commenced the construction of a two-mile branch of the Buffalo, Rochester & Pittsburgh R.R., from Craigsville, Penn., into Butler County. The purpose of the line is to tap the limestone and coal fields along Buffalo Creek and the lower part of Butler County. The line will be completed this summer.

Columbus, Ohio—The Hocking Valley Ry. Co. has awarded the contract for the extension of a branch line through Kerr's Run into what is known as Nease settlement in the Pomeroy Bend mining district. The work will be started at once unless obstructed in obtaining the right-of-way. The proposed line will open a large coal area east of Hamden, Ohio.

Kittanning, Penn.—The Allegheny River Mining Co. one of the Shawmut interests is about to build 100 new dwellings for miners on Furnace Run, three miles above this town on the right bank of the Allegheny. The new tipple is rapidly nearing completion and within 30 days it is hoped that coal will be dumped over it. Two new motors will be taken into the mine on Saturday.

Grafton, W. Va.—Work was started recently to construct a second coaling plant near Independence, that will develop the large tract of valuable coal land owned by Madame DeBiliers. Messrs. Late, of Clarksburg, and Irving, of Pittsburgh, have now leased the DeBiliers property and have been working for several weeks making tests of the coal and preparing for beginning active construction of a coal plant.

Superior, Wis.—Work has been started on the improvements at the Hanna dock. When completed this work will represent an outlay of $500,000. A contract for the superstructure has been awarded to the Mead-Morrison Construction Co. of Chicago. Other contracts calling for dredging and crib work are pending. The improvements will be made on a 12-acre tract recently acquired by the Hanna company at a cost of several thousand dollars. When all improvements have been completed the dock will have a handling capacity of over one million tons annually, an increase of 350,000 tons.

NEW INCORPORATIONS

Donaldsonville, La.—The Consumers Coal Yard & Supply Co.; capital stock, $10,000. President, R. N. Sims.

Clarksburg, W. Va.—Fifty-foot Fuel Co., was incorporated with a capital stock of $25,000 to develop coal lands.

St. Louis, Mo.—The Imperial Coal Co.; capital stock, $8000. Incorporators: D. G. Jackson, F. S. Suerer, and B. E. Hefter.

Hopkinsville, Ky.—The West Kentucky Fuel Co.; capital stock, $5000. Incorporators: Paul Winn, Sam Winn and James Breathitt.

St. Louis, Mo.—The Universal Smokeless Fuel Co.; capital stock, $50,000. Incorporators: Jas. M. Moran, Asa A. Loudon, and Alfred Mueller.

Andalusia, Ala.—The Black Warrior Mill Co. has been incorporated with a capital stock of $100,000 to install sawmills and develop coal and timber lands.

Cincinnati, Ohio—The Cleveland & West Virginia Coal Co.; D. F. Bevington, C. F. Becker, L. E. Bevington, A. C. Becker and J. E. Matthews, all of Cleveland, Ohio.

Montgomery, Ala.—Cahaba Central Coal Co. of West Blocton was incorporated by the Secretary of State, Mar. 12.

Capital stock, $20,000. Incorporators: W. R. Young and G. W. Randall.

Pueblo, Colo.—The Cañon City Coal & Development Co.; capital stock, $100,000; to mine coal and develop coal properties. Incorporators: Joseph Walton, Mrs. Joseph Walton and L. A. Wieland.

Chattanooga, Tenn.—The Tennessee Coal & Coke Co.; capital stock, $100,000; to mine coal in Hamilton County. Incorporators; J. F. Walters, L. N. Spears, W. D. Spears, G. D. Lancaster and M. O. Cates.

Nashville, Tenn.—The Hazel Creek Coal Co.; capital stock, $120,000; to mine, sell and deal in coal, ore and minerals; to bore for oil, etc. Incorporators: C. C. Christopher Lee Brock, John H. Carpenter, A. R. Hill and L. A. Powers.

Philippi, W. Va.—The Meriden Coal & Coke Co.; capital stock, $3,500,000. Incorporators: Wiliam P. Hurst, Harvey R. Hurst, Richard H. Parker, James R. Hurst, of Scottsdale, Penn., and Fuller Hoggsett, of Uniontown, Penn.

Logan, W. Va.—The Island Creek Colliery Co.; mining coal; capital stock, $50,000. Incorporators: H. M. Vest, Welch, W. Va., P. A. Grady, Roderfield, W. Va., Fred C. Prichard, Rufus Switzer and Thomas A. Wiatt, of Huntington, W. Va.

INDUSTRIAL NEWS

Rich Hill, Mo.—F. A. Griffin will develop 1000 acres of coal property, and is preparing to sink a shaft.

Toledo, Ohio—It is rumored that a gas well, estimated to flow more than 30,000,000 cu.ft. per day, has been drilled near Butler, Penn. The well started with 700,000 cu.ft. daily but after it had been cleaned out the great flow began.

Coshocton, Ohio—A bed of coal seven feet in thickness has been discovered on the Leander McVey farm in the Mohawk-Walhonding vicinity. Work of developing will be begun at once.

Pittsburgh, Penn.—It is reported that J. P. Morgan & Co. have concluded negotiations with Col. J. M. Guffey for the purchase of 100,000 acres of West Virginia coal land. The price paid is said to be $10,000,000.

Connellsville, Penn.—A mine, which has been operated until 1909 by the Ashville Coal & Coke Co., has been reopened under the direction of C. P. Burtner, of Altoona, and is now producing coal.

Reading, Penn.—The Philadelphia & Reading Coal & Iron Co. has started storing coal at Landingville. About 200 carloads are dumped daily. This is the first attempt to store coal for nearly a year.

Chicago, Ill.—The Susquehanna Coal Co. of Pennsylvania has acquired a tract of 24 acres of land at the corner of Muskegon Ave. and 116 St. which is to be used eventually as a coalyard. The price paid is said to have been in the neighborhood of $75,000.

Birmingham, Ala.—Judge Grubb has taken under advisement the petition filed by the trustees of the Alabama Consolidated Coal & Iron Co. asking for an order of sale for the properties of the company. It is probable that his decision will be announced Mar. 22.

Brownsville, Penn.—The Pike mine, owned by the People's Coal Co., will be sold to the Jones & Laughlin interests. This mine, which is located close to the Brownsville borough line, has been idle for nearly three years. The mine will employ about 200 men.

Birmingham, Ala.—The Tennessee Coal, Iron & R.R. Co. has struck coal in the slope sunk for the development of their No. 16 Pratt mine, on the Birmingham Southern R.R., about 10 miles northwest of Birmingham. The town at this point will be called Bayview.

Batavia, N. Y.—Within the last few days there has been considerable talk about prospecting for coal in this vicinity and making another effort to finance a project to continue work on the shaft which was sunk 40 years ago on the Gayton farm, a mile east of Stafford.

Shamokin, Penn.—Three large Cochrane feed-water heaters have been received by the Philadelphia & Rading Coal & Iron Co. for service at the Henry Clay, Burnside and Bear Valley collieries. The first Cochrane heater was tried out at the Locust Gap colliery and proved to be entirely satisfactory.

Jenkins, Ky.—The Consolidation Coal Co. has completed its big electric power plant, and will hereafter operate its mines with its own power. The plant will also supply current to the surrounding mining towns of Dunham, Burdine and McRoberts, as it possesses five power units, with an aggregate capacity of 13,000 horsepower.

Fayette, Ia.—A deal has just been closed by which the Big Joe Co. gets the Big Four mine on the Milwaukee, eight miles west of Centerville. The company has also leased 500 acres of coal land near Jerome and expects to sink a new shaft. Two hundred men will be employed by fall. Robert Hunter is the superintendent.

Clinton, Ind.—A visit of Clay F. Lynch, general manager of the Bunsen Coal Co., a United States Steel Corporation subsidiary, to the Miami Coal Co.'s two mines south of here, has led to a report that the Bunsen company is going to buy the Miami mines. It is said to own the coal lands surrounding the tract of the Miami company.

Charleston, W. Va.—The appointment of receivers to take charge of the properties of the New River Co. and its 17 subsidiary companies has been denied by the Supreme Court of Appeals of West Virginia. This reverses the decision of the Circuit Court of Fayette County. The New River Company, is a $30,000,000 coal corporation.

Morgantown, W. Va.—Holdings of the Kingwood Coal & Coke Co., situated on the West Virginia Northern and the Morgantown & Kingwood railroads, in the vicinity of Kingwood, have been sold to Cleveland capitalists. The consideration named in the sale of the property is $60,000. It is understood that the Cleveland purchasers will develop the properties.

Brazil, Ind.—At the Schrepfman Coal Co.'s mine No. 1 two seams of block coal are worked. Several hundred yards from the main shaft another shaft rises from the bottom seam to the top or rider vein. The coal mined in this seam is lowered to the bottom and thence hoisted by cages in the main shaft. This gives rise to the peculiar situation of two mines in one.

Pineville, Ky.—A deal has been consummated by which the Lick Branch Coal Co. has leased the mining plant of the Harlan Coal Mining Co. at Croxton. The minimum royalty for the first five years amounts to approximately $100,000. The Harlan Coal Mining Co. is composed of Barbourville and Louisville capitalists and will begin at once the development of other property which it owns in southeastern Kentucky.

Taylor, Ky.—An effort is being made by the Taylor Mining Co., which operates mines in Ohio County, in the western Kentucky coal field, to induce its employees to improve the appearance of their houses by the cultivation of gardens and lawns. To this end the company is offering a prize of $10 in gold for the best garden, with a second prize of $5, and a first prize of $7.50 in gold for the best lawn, with a second prize of $2.50.

Pottsville, Penn.—The Philadelphia & Reading Coal & Iron Co. at Shamokin has let a contract for a tunnel to be driven from the No. 5 seam which will cut Nos. 6, 7 and 8. All of these have been tested and found to be of excellent quality and of minable thickness. The recent improvements at Sterling and Burnside collieries will make the twin colliery one of the most valuable in this section of the anthracite region.

Cincinnati, Ohio—It is expected that plans for the dissolution of the Sunday Creek and other coal mining companies of eastern Ohio and West Virginia and coal carrying roads will be presented to the U. S. District Court Mar. 29. The railroads named in the dissolution order which was filed at Columbus include the Lake Shore, the Toledo & Ohio Central, the Hocking Valley, the Chesapeake & Ohio and the Kanawha & Michigan.

Charleston, W. Va.—Negotiations for the sale of the Dickson Pocahontas Coal Co.'s properties in the Pocahontas field have been completed. The purchasing company is the Lake Superior Corporation which owns the Cannelton coal properties in the Kanawha district, and has its principal headquarters at Sault Ste. Marie. The consideration is said to have been $500,000 and it is reported that the purchasing company has set aside $200,000 for development work.

Pottsville, Penn.—The Lehigh Valley Coal Co. has equipped several additional fire cars for fighting fires in its mines. They consist of the truck of a mine car upon which is mounted an electric pump which is capable of delivering 300 gal. of water per min. In addition to this they each carry two large 30-gal. chemical extinguishers to be used where water is not available and a number of smaller extinguishers. Axes, buckets and complete first-aid outfits also figure in the equipment. These cars are kept above ground near the mouth of the shafts and can be lowered in a few seconds to be taken to any point of the mine where the track is laid.

COAL TRADE REVIEWS

GENERAL REVIEW

While there has been an occasional order for hard coal during the week, buying has been pretty definitely concluded, pending the arrival of spring prices on Tuesday next. April orders are not coming in as promptly as usual, and there is not much enthusiasm in the trade over the prospects for that month. Of course, dealers will lay in some stocks, but the disposition is to go slow. However, most of the hard-coal business automatically renews itself, and wholesalers are not seriously worried over the outlook, although the market is at a standstill and suspensions are the rule.

There is quite a volume of coal moving on spot orders in the Eastern bituminous trade, and also on contracts expiring Apr. 1. Consumers are obviously endeavoring to stock sufficiently to carry them over for some time. Shippers are inclined to hold off on April business, but are endeavoring to place prompt tonnages, while orders for same are not plentiful. The situation hinges to a greater or less extent on the West Virginia labor troubles; even in event of a general lockout, it is not probable there will be any great shortage of coal.

Shipments to the Northern markets are still heavy, but few companies are able to place their full output, and many mines are working short time. Still there is a large consumption due to considerable industrial activity, and prices as a rule are being well maintained, although quotations are uncertain and at times conflicting. Production continues to increase in the Pittsburgh district, due to the opening of the Lake trade; prices are fairly steady, but they may experience a break at any time, due to considerable shading of quotations in other fields. Large producers are holding especially firm, and although there is some price cutting on the part of the smaller operators, it is not regarded as of a serious nature.

Preparations are being made in Ohio for a heavy Lake tonnage, and business is fairly active; there has been some falling off in domestic, but prices continue firm. Steam business has also been restricted somewhat, but there is considerable activity in railroad contracts and production for the week has been fairly strong.

In the Middlewestern market, production is at a low point, the mines working half time or less; however, it is stated that orders as a rule are in excess of those for the same period last year, and the new contracts are being closed at the same figures. Contracting is the only active branch of the business at the moment. There was some increased demand for Illinois coal, but operators over-shipped the market and caused another break; it is stated that there is a movement under way to curtail production in this district. Demand in the Rocky Mountains has slowed down quite materially, due to warmer weather.

BOSTON, MASS.

Bituminous—The bituminous situation turns on the probability of strike troubles in the New River district. There is a dearth of anything like definite news on the subject but the same shippers who are striving to place spot coal at current prices are holding back on business after Apr. 1. The spot market, if anything, is a shade weaker and all the agencies have an abundance of coal at the Virginia terminals. Quite a volume has been fed to this market, either at prices considerably off the contract figure for the coming season or else shipments are being liberally applied to contracts expiring Mar. 31. Even if there should be a cessation of work in New River this market would probably get on for some months without any pronounced price movement. And if there is no trouble we are almost certain to have a dull spring followed by a summer not unlike that of 1911. What yearly business has been closed has been with the usual strike clause and the now customary protection against a decline in the market.

The shippers of Georges Creek have named a tentative price of $2.85 f.o.b. Baltimore, or $1.60 at the mine, but the trade is not taking it very seriously as a year-round price. Orders for this grade are plentiful now but this is early in the season. The Pennsylvania coals are mulling along on about the same basis as previously reported. There are signs of slightly lower prices here and there as operators find orders getting scarce. It may be said that for better grades from the Clearfield district, prices at the mine are about 5c. off from a week ago and the demand is more spasmodic. In the all-rail territory consumers are guarded in making purchases. There is no snap to the business in any quarter and the prospect is not particularly good for the prices set a few weeks ago.

Water Freights are also off, 70@80c. having been accepted for the largest vesels, Hampton Roads to Boston; 40c. is about the rate from New York to points on Long Island sound.

Anthracite—There is not much enthusiasm on the part of the anthracite dealers for early April shipment. Most of them will lay in a fair stock at April prices but the disposition is to go slow. The companies who are the largest distributors to this market are understood to have a fair amount of spring business in hand. Those, however, who did little for New England in 1912 are meeting with rather a cool reception, and buyers rather than sellers are drawing the lines this year. It is expected that retail prices in Boston will be reduced on or around Apr. 1 from $8 to $7.50 for stove and chestnut, with 25c. less for egg.

Current wholesale quotations on bituminous are about as follows:

Clearfields, f.o.b. mine	$1.00@ 1.35
Clearfields, f.o.b. Philadelphia	2.25@ 2.60
Clearfields, f.o.b. New York	2.55@ 2.90
Cambrias, Somersets, f.o.b. mines	1.25@ 1.50
Cambrias, Somersets, f.o.b. Philadelphia	2.50@ 2.75
Cambrias, Somersets, f.o.b. New York	2.80@ 3.10
Pocahontas, New River, f.o.b. Hampton Roads	2.60@ 2.80
Pocahontas, New River, on cars Boston	3.65@ 3.85
Pocahontas, New River, on cars Providence	3.45@ 3.75

NEW YORK

Bituminous—The local soft-coal market continues at the same relatively low ebb prevailing over the last few weeks. Interest is concentrated entirely on contracting, which is becoming more active as the season advances. In fact, the business became quite active on small contracts during the week, but it might be stated that this was the result of the most persistent endeavors on the part of the sales agencies. The large contracts are still hanging fire, the buyers being firm in the belief that plenty of tonnages will be available at last year's figures. What the ultimate result will be is more or less problematical, but present indications are that both sides will ultimately grant concessions.

Stocks at tidewater are about normal or a little low approximately the same as last week. Production in the mining regions continues at a good pace and is much more steady than in hard coal. The spot demand is rather slow with prices weak, particularly on the off qualities, there being a fairly steady demand for the high-grade fuels, and prices firm. The local market is not changed from last week, which we quote as follows: West Virginia steam $2.55@2.60 fair grades, Pennsylvanias, $2.65@2.70; good grades of Pennsylvanias, $2.75@2.80; best Miller, Pennsylvania, $3.05@3.15; Georges Creek, $3.25@3.30.

Anthracite—Production at the hard-coal mines is only about 50 per cent. capacity, and the trade is absolutely devoid of interest; the demand is scarce with the exception of pea size, for which there seems to be a fairly steady consumption. However, the large companies are most optimistic about the future. The Western stocks are well cleaned up, and a strong healthy demand is expected to develop when the April discounts go into effect on next Tuesday. So firm are some companies in this belief that they have issued instructions to the operating departments that, effective Apr 1, the mines would work continuously. It seems reasonable to believe that such will be the case for two or three months at any rate, after which it is difficult to say what the conditions will be. Some dealers are of the belief that consumers were left with enough coal on hand to carry them over to next spring, because of the unusually mild winter. Also the comparatively long suspension last spring forced many hard-coal consumers to use bituminous, which they have continued with since.

Prices are quite easy on the following basis:

	Circular	Individual — Lehigh	Individual — Scranton
Broken	$5.00	$4.50 @ $5.00	$4.50
Egg	5.25	4.50 @ 4.70	4.55 @ 4.75
Stove	5.25	4.50 @ 4.70	4.55 @ 4.75
Chestnut	5.50	4.70 @ 4.95	4.75 @ 5.00
Pea	3.50	3.35 @ 3.45	3.45 @ 3.55
Buckwheat	2.75	1.95 @ 2.45	2.50 @ 2.75
Rice	2.25	1.80 @ 1.95	2.10 @ 2.25
Barley	1.75	1.25 @ 1.55	1.55 @ 1.75

PHILADELPHIA, PENN.

Coal yards are not a particularly lively asset at the present time as dealers are simply waiting for the opening prices. Occasional orders are being received, but most of them are employing their time in making needed repairs to yards, and getting things in shape to handle the April business. While orders for April delivery are not coming in rapidly, the dealers are looking forward to a good business at least during the coming month. Most if not all of them have a class of business which renews itself automatically during April, year after year. Large residences, churches, etc., with generous storage capacities, try to get as much of their winter supplies as possible, when quotations are the lowest, and it is this class of business that will keep the trade moving.

The wholesale market is almost at a standstill, at least, as far as the large companies are concerned. Suspension was universal over the Easter holidays, but operations were resumed at most collieries Monday, and will doubtless continue until April, surplus coal, being placed in storage. It is understood that many of the companies are already starting coal toward their shipping ports on the lakes, and will load vessels, as promptly as they can be secured. Ice conditions on the Lakes are such that the movement is not likely to become effective for a week or more at the least, and, of course, shipments in that direction are limited to the number of vessels available.

The bituminous market is still sluggish. Higher prices are still talked about for new contracts, and it is understood that more than one large buyer is holding off for this reason. The resumption of work in the West Virginia fields is not likely to improve conditions to any extent, and the advance in price may have been founded on the assumption that these fields were no longer a factor.

PITTSBURGH, PENN.

Bituminous—Mine operations in the Pittsburgh district at the increased rate in last report have continued, but the slight gain is due only to the starting of shipments in the Lake trade, since general demand has been far from good, owing to warm weather. Prices are fairly steady for Pittsburgh district coal, but are under fire on account of shading in other fields. Large producers are adhering to their regular prices more tenaciously than for a long while, and the shading by small interests is not regarded as of much moment. The market is generally quotable at regular prices, subject to occasional shading by small interests. Slack rarely brings a premium now, on account of heavier production through the shipping of Lake coal. We quote regular prices: Slack, 90c.; nut and slack, $1.05; nut, $1.25; mine-run, $1.30; ¾-in., $1.40; 1¼-in., $1.55, per ton at mine, Pittsburgh district.

Connellsville Coke—A little light has been thrown upon the condition as to contract-furnace coke, which had for some time been nominally quoted at about $2.50, in the absence of sales or serious inquiry. A furnace company in Cleveland has closed a contract for 5000 tons a month for four months to July 1 at $2.25, ovens, it being understood that coke, standard in every respect, was secured. The majority of operators, however, would not touch this figure either for early shipment or for the second half. There is tentative inquiry for the later delivery, but no serious negotiations. Sales of standard coke for prompt shipment have been made at $2.43, while off coke continues to be offered at relatively low prices, a fairly well known grade running about 1.2 per cent. sulphur being freely offered at $2.15. We quote the market as follows: Prompt furnace, $2.45@2.50; contract furnace, $2.25@2.50; prompt foundry, $3@3.50; contract foundry, $3@3.50 per ton at ovens.

Production and shipments of Connellsville coke continues at record rate, although there may be a slight decrease this week from after effects of the Easter celebration. The labor supply, however, has been good in the past few weeks and no shortage may be experienced. Some operators are surprised at the maintenance of prices, for precedent shows anything above $2 to be above average, when the tonnage moved is so large, but consumption is likewise at record rate, since the country is making pig iron at the rate of about 34,000,000 tons annually and no serious decrease is likely in the near future.

BALTIMORE, MD.

Although consumers have hesitated about renewing contracts because of the advanced prices asked by the trade, it is believed that practically all of them will have closed for their fuel requirements over the next year by Apr. 1. More complaint has been heard regarding the higher price which the trade is demanding for the better grades. A number have endeavored to procure coal at last years figures, but they have not succeeded, except in a few cases, where the operator thought that the price gave a pretty good profit in the first place. In order to get the best possible results from coal several consumers have conducted a series of tests for the purpose of ascertaining if the low-grade coals could be substituted for the more expensive product which they had been using.

The market was well stocked with fuel during the week, especially with good coking coals, due to the decrease in the output of coke.

BUFFALO, N. Y.

In anthracite the consumers and retailers are waiting for April prices, and the output of bituminous is now so large that only the expert salesman is able to sell up to full capacity. On this account a good many bituminous mines are again running on part time.

It is hard to say what the summer market is going to be. The Pittsburgh district operators are holding to their specified prices and Buffalo dealers who handle that coal or Youghiogheny agree that there has been no discounts offered yet. Still there is plenty of coal offering at less than $1, mine-run, at the mines, some of doubtful quality and some fair. Just how these conflicting prices are to be reconciled is not settled yet; it is not easy to see how both can be maintained. Some mines can put out coal at less than $1 but a great many cannot. The consumer is able to pay the full price, but he will, of course, buy as low as he can and this conflict in prices will be pretty sure to take up the entire season.

This section is consuming a large amount of coal and will continue to do so, as all industries are active and the number and capacity is steadily increasing. The territory east and north covered by Buffalo dealers in bituminous is well maintained, more coal being sold every year. The market for Pittsburg coal is steady, though not active at $2.80 for lump, $2.65 for three-quarter, $2.55 for mine-run and $2.15 for slack, with Allegheny Valley selling at about 30c. less. The coke market is still pretty slack, best Connellsville foundry selling at $5.

Anthracite will be dull till the April reduction of price is in effect. There is quite a large surplus now and the companies are loading lake vessels at a good rate, having about 100,000 tons afloat here now. Retailers are doing little business.

COLUMBUS, OHIO

Conditions in Ohio have been fairly good during the past week. The steam trade is moving along smoothly and preparations are being made for a record-breaking Lake movement. Taking it all in all the coal trade is as active as could be expected at this time of the year and the tone is satisfactory.

Prices have ruled firm dispite the falling off in the domestic demand. Only small orders are being received from retailers and not a great deal is expected from that source until the stocking up season starts. Steam business has been fairly large although some of the plants have curtailed their requirements. This is especially true of iron and steel concerns. Other lines of manufacturing are running full and the fuel requirements are normal.

Coal men generally believe that the slight falling off in the demand for steam grades on the part of manufacturing establishments is only temporary. They believe that industrial conditions will remain active and that many large users will be in the market for a greater tonnage in the near future. Outside of the railroad fuel contracts there is considerable activity shown in renewing steam contracts, many of which expire around Apr. 1.

Chartering of lake boats is now on in full sway. All of the operators which usually enter the lake trade have secured bottoms and some of the larger producers have started to load vessels. There will be a large tonnage ready for shipment just as soon as the ice is out of the Soo which it is believed will be around Apr. 15, but may possibly be earlier.

Production has been only fair during the weak. In the Pomeroy Bend field the output is estimated at 70 per cent. and the Hocking Valley produced about 65 per cent. of normal. In Eastern Ohio the production has been about 65 per cent. also. In the purely domestic fields the output has been small.

Quotations in the Ohio fields are as follows:

	Hocking	Pittsburgh	Pomeroy	Kanawh
Domestic lump	$1.45	.....	$1.50	$1.40
¾-inch	1.35	$1.20	1.35	1.30
Nut	1.30	....	1.30	....
Mine-run	1.15	1.10	1.15	1.10
Nut, pea and slack	0.80	....	0.75	0.80
Coarse slack	0.70	0.80	0.65	0.70

HAMPTON ROADS, VA.

There is a distinct feeling of a coming improvement in conditions and contract prices for the new year are being closely adhered to, notwithstanding the fact that many large buyers are still holding off. Few, if any, of the large contracts have been closed; none of the Chesapeake Bay transportation lines, who use the greater part of the local product, have definitely arranged for their coal yet.

BIRMINGHAM, ALA.

Inquiries are now coming in from many of the railroads and specifications, as a rule, call for heavier tonnages than were bought during the year ending June 30, 1913. Most of the railroads are using more than the maximum of their contracts at the present time. One of the largest railroad inquiries is for approximately 300,000 tons for delivery over one year beginning July 1, 1913. A number of the roads have expressed a willingness to pay higher prices than heretofore if better prepared coal can be obtained.

There is no material change in the steam or domestic market, although prices are not as high as during March of last year on account of the unusual conditions prevailing at that time. Several new mines will be put into operation during the summer and a larger bid than ever will be made by the Alabama operators for export business. The foundry coke market is holding its own quite well indeed when it is considered that the pig-iron melt is somewhat below normal at the present time.

LOUISVILLE, KY.

Prices on Eastern Kentucky domestic grades are quoted almost without reference to market conditions. With best block at $1.50, lump and block at $1.40, and round at $1.15, it may be gathered that the demand is nothing brisk. Mine-run can be had at 85c., although there are quotations as high as $1.05. Whether these would yield to a bona fide offer of a substantially lower figure is another question. Firstclass nut and slack is in demand at 90c. to $1, and second grades at 75 and 80c. Pea and slack, from both sections of the state, is quoted at 45c.; western Kentucky lump at $1.25 and nut at $1.10 are not moving to any extent.

INDIANAPOLIS, IND.

With the movement of coal at the low ebb, operators are concerning themselves in renewing the expiring contracts. Notwithstanding the low prices prevailing in the open market, the companies say they are having little trouble in closing at the old figures. In domestic, buying is practically over for the winter, large retailers still having enough on hand or coming in to fill all probable needs. They believe they will sell some coal yet, though the periods of cold weather may be short. Mine-run, No. 4 is selling anywhere from $1.05 to $1.20. Screenings are strong at 90c. to $1 and scarce on account of the small demand for domestic.

Some of the larger mines are running better than half-time but the smaller companies do well to get in three days a week. The weather generally is spring-like but there is still an occasional day or two of winter; these cold spells bring a good sprinkling of coal wagons on the streets. Local retail prices still hold to the high winter schedule.

DETROIT, MICH.

Several large coal operators declare that their orders are greater than for the same period last year, by as much as 10 per cent., and also that the price basis per ton is approximately from 5 to 10c. better than were the figures obtained last season.

The prevailing prices on the local market are as follows:

	W.Va.	Gas	Hocking	Cambridge	Ohio No. 8	Pocahontas	Jackson Hill
Domestic lump	$1.40	....	....	....	....	$1.65	$1.75
Egg	1.40	....	....	....	....	1.65	1.75
1½-in. lump	1.20	....	....	....	....	....	....
¾-in. lump	1.00	$1.10	$1.00	$1.00	$1.00	....	....
Mine-run	0.90	0.90	0.90	0.90	0.90	1.15	....
Slack	0.80	0.85	0.80	0.80	0.80	0.95	....

Anthracite conditions have not changed much in the past few weeks. The usual light end-season demand is being handled with ease from stocks on hand, and shipments from the East to this point, have been comparatively insignificant.

CHICAGO

A large number of contracts are being negotiated in the Chicago market and this is, practically, the only activity. If operators were compelled to rely upon spot sales they would soon be out of business. There have been an unusually large number of sales of screenings and mine-run on contract. In all instances the operators have obtained what they call fair prices.

Chicago dealers have been participating, in a large measure, in the closing of contracts for Lake shipments. It is expected that a big tonnage will be moved at prices higher than those prevailing a year ago. The coke market is dull. Hocking Valley operators are not shipping any coal into this market and are reserving what free coal they have for the Lake movement.

Prevailing prices in Chicago are:

	Springfield	Franklin Co.	Clinton	W. Va.
Domestic lump	$2.07@2.22	$2.45@2.55	$2.27	
Egg		2.45@2.55		$3.95
Steam lump	1.92@1.97		2.17	
Mine-run	1.87@1.92	2.20@2.30	1.97	3.30
Screenings	1.57@1.62	1.90@1.95	1.67	

Coke—Connellsville and Wise County, $5.75@6; byproduct, egg, stove and nut, $4.75@5.35; gas house, $4.75@5.35.

ST. LOUIS, MO.

There has been some little encouragement to the retail coal man, inasmuch as there was a good demand for very small lots of coal, but on the whole this did not affect the shipping market in the least. As a matter of fact, if anything, it created a disturbance that brought prices lower than they have been thus far this season, and especially was this so on the better grade coals.

Over-production still continues, but there is hope now that conditions will improve, inasmuch as some of the operators are in a movement to suspend operations for the next three or four months. Washed coals are in fairly good demand, and from this time on these grades will continue to get better.

The prevailing circular is:

	Carterville and Franklin Co.	Big Muddy	Mt. Olive	Standard
2-in. lump	.....	.....	.....	$0.85 @ 0.90
3-in. lump	.....	.....	$1.25	.....
6-in. lump	$1.20 @ 1.25	.....	1.35	1.10
Lump and egg	1.25	$2.25	.....	.....
No. 1 nut	1.10 @ 1.15	.....	.....	.....
Screenings	0.90 @ 0.95	.....	.....	0.65
Mine-run	1.05 @ 1.15	.....	.....	0.85
No. 1 washed nut	1.40 @ 1.50	.....	.....	.....
No. 2 washed nut	1.35 @ 1.45	.....	.....	.....
No. 3 washed nut	1.25 @ 1.30	.....	.....	.....
No. 4 washed nut	1.15 @ 1.20	.....	.....	.....
No. 5 washed nut	1 00 @ 1.05	.....	.....	.....

MINNEAPOLIS—ST. PAUL

Steam business is reported rather lax as industrial concerns seem to be content with only enough stocks to run them a short period. It is generally thought that the early summer months will be slow for the wholesaler and jobber as conditions point to low prices at least up until the latter part of July or the first part of August. After that, with the oncoming of winter, business ought to be good with healthy prices prevailing. Then after the first of next year, wholesalers should find business exceptionally good in view of the fact that the present aggreements with the soft-coal miners will be drawing to a close.

PORTLAND, ORE.

Just as the people of the Pacific Northwest were beginning to believe that spring had come with sunshine and balmy breezes, a cold wave swept over the country with from two to eight inches of snow. The effect has been a revival in the coal business, giving the dealers their second inning this season; however, prices are unchanged and the present cool spell will have no effect on values.

OGDEN, UTAH

The Wyoming and Utah mines have had a great many idle days, due to lack of lump or nut orders. There have been flurries of storms and cold weather in various parts of the territory, but these have not been of long enough duration to effect shipments materially. The Wyoming operators have been watching the storm in Nebraska for the past week but to date the effect has not reached the mines.

Wyoming operators have announced April and May quotations for Nebraska shipment as follows: Lump, $2.25; nut, $2; mine-run, $1.75; slack, $1. This will have a tendency to decrease shipments during the latter part of March, but should increase the movement of coal in April.

While quotation of the various grades have not changed, the selling price on nut and slack has been fluctuating. Nut coal has varied $1.75 to $2.25 per ton, while slack is selling from 50c. to $1, according to the demand. Lump coal in the Northwest remained firm at winter quotations and will probably not be changed until summer storage prices are encountered.

PRODUCTION AND TRANSPORTATION STATISTICS

NORFOLK & WESTERN RY.

The following is a comparative statement of the coal and coke shipments over the lines of the N. & W. Ry. for the months of February and the first 2 months of 1912 and 1913 in short tons:

Destination	February		2 Months	
	1912	1913	1912	1913
Coal				
Tidewater, foreign	107,689	122,944	219,893	267,006
Tidewater, coastwise	287,724	337,202	535,943	646,120
Domestic	1,388,888	1,413,398	2,716,413	3,030,292
Coke				
Tidewater, foreign	3,988	4,909	8,544	9,964
Domestic	133,936	147,938	261,020	291,134
Total	1,922,225	2,026,391	3,741,813	4,244,516

SOUTHWESTERN TONNAGE

The following is a comparative statement of the Southwestern production for September and October, 1911 and 1912:

State	September			October		
	1911	1912	Change	1911	1912	Change
Missouri	202,404	242,871	+40,467	228,248	315,419	+87,171
Kansas	401,536	424,329	+22,793	447,699	524,315	+76,616
Arkansas	133,238	169,325	+36,087	147,409	205,031	+57,622
Oklahoma	229,300	249,604	+20,304	274,858	369,717	+44,859
Totals	966,478	1,086,129	119,651	1,098,214	1,364,482	+266,268

This statement only covers the tonnage of members of the Association which we estimate to be at least 95% of the entire tonnage produced in the four States.

IMPORTS AND EXPORTS

The following is a comparative statement of imports and exports in the United States for January 1912-13 and for the 7 months ending January 1911-12-13, in long tons:

	7 Months			January	
Imports from:	1911	1912	1913	1912	1913
United Kingdom	10,199	5,644	7,218	1,445	1,168
Canada	1,001,018	513,569	843,962	100,744	109,520
Japan	6,313	7,057	30,004	.....	5,494
Australia & Tasmania	190,157	143,140	98,308	21,903	10,113
Other countries	4,709	915	448	696	.....
Total	1,212,396	670,325	979,940	124,788	126,295
Exports:					
Anthracite	1,691,981	2,069,493	2,863,111	221,638	305,569
Bituminous,					
Canada	5,164,428	7,079,617	7,002,875	402,966	565,196
Panama	291,134	250,273	269,759	19,588	64,567
Mexico	373,148	185,302	155,216	31,639	43,778
Cuba	523,237	638,032	706,776	78,789	117,109
West Indies	302,214	375,620	329,436	77,151	72,233
Other countries	348,240	439,717	563,114	57,346	113,080
Total	7,002,401	8,968,561	9,027,176	667,479	975,963
Bunker coal	3,692,418	3,913,684	4,489,343	553,140	612,689

COAL MOVEMENT IN 1912

The following is a summary of the combined coal and coke movement over various railroads for December and the years noted, in short tons:

	December		Year	
	1911	1912	1911	1912
Bal. & Ohio[1]	3,113,295	3,392,925	35,321,771	40,525,280
Buf. Roch. & P.[1 2]	725,689	773,194	8,223,617	8,839,732
Buf. & Susq.[2]	183,147	164,235	1,951,256	1,810,930
Chesp. & Ohio[2]	1,548,881	1,290,588	16,488,024	17,296,185
Hunt. & Br'd. T. M.[1 2]	692,427	688,248	8,031,463	7,803,773
N. Y. C. & H. R. R.R.[2]	136,564	150,771	1,148,675	1,277,180
N. & W. R.R.[1 2]	757,636	833,454	8,108,738	8,396,018
Penn. R.R.[1 3]	1,931,313	1,832,251	20,954,839	24,112,787
Pitts. & Lake Erie[2]	6,107,262	6,551,301	65,015,701	70,117,880
Pitts. Sha. & Nort.[2]	1,243,926	1,517,651	16,090,905	17,745,835
Southern	136,448	212,477	1,459,637	2,033,169
Virginian[2]	328,257	292,824	4,826,794	4,062,363
Western Md.	[2]258,869	317,508	2,817,201	3,584,292
	260,277	204,029	2,673,183	2,838,331

(1) Includes coal received from connecting lines.
(2) Includes company's coal.
(3) Does not include company's coal hauled free.

PENNSYLVANIA RAILROAD

The following is a statement of shipments over the P. R.R. Co.'s lines east of Pittsburgh and Erie for Feb. and first two months of this year and last year in short tons:

	February		Two Months	
	1913	1912	1913	1912
Anthracite	988,036	1,107,226	2,002,295	2,147,761
Bituminous	3,857,304	4,086,917	8,067,500	6,668,282
Coke	1,220,360	1,023,253	2,508,874	1,964,184
	6,065,700	6,217,396	12,578,669	11,780,227

FOREIGN MARKETS

GREAT BRITAIN

March 14—New business is of a quiet character, owing to the fullness of colliery order-books and the difficulty of getting loading berths.

Prices are approximately as follows:

Best Welsh steam	$4.62@4.68	Best Monmouthshires	$4.20@4.26
Best seconds	4.50@4.56	Seconds	4.08@4.14
Seconds	4.38@4.44	Best Cardiff smalls	3.78@3.84
Best dry coals	4.44@4.50	Seconds	3.54@3.60

The prices for Cardiff coals are f.o.b. Cardiff, Penarth or Barry, while those for Monmouthshire descriptions are f.o.b. Newport; both exclusive of warfage, and for cash in 30 days—less 2½%.

GERMANY

The following is a comparative statement of German production, imports and exports for January of 1912-13:

	Exports		Imports		Production	
Coal	2,452,695	2,386,249	759,501	663,319	13,565,606	16,536,115
Lignite	5,246	7,238	591,830	503,704	6,865,208	7,375,566
Coke	425,812	628,164	50,171	49,853	2,340,366	2,724,871
Coal briquettes	156,485	207,053	3,324	2,590	424,961	498,288
Lignite briquettes	59,613	129,129	13,223	9,294	1,497,060	1,771,187

COAL SECURITIES

The following table gives the range of various active coal securities and dividends paid during the week ending March 22:

Stocks	Week's Range			Year's Range	
	High	Low	Last	High	Low
American Coal Products	90	90	90	87	87
American Coal Products Pref	109½	109½	109½	109½	109½
Colorado Fuel & Iron	33	31	32	41½	31
Colorado Fuel & Iron Pref	....	....	155	155	150
Consolidation Coal of Maryland	102¼	102¼	102¼	102¼	102¼
Island Creek Coal Pref	86	85	85	....	....
Lehigh Valley Coal Sales	240	204	204	....	....
Pittsburgh Coal	19⅜	19	19	24⅜	19
Pittsburgh Coal Pref	84½	80⅜	82	95	80⅜
Pond Creek	23⅜	22	23⅜	28½	22
Reading	156⅜	153⅞	155½	168⅞	152½
Reading 1st Pref	90¼	90	90¼	91⅛	89⅞
Reading 2nd Pref	90	90	90	93	87⅞
Virginia Iron, Coal & Coke	50	50	50	54	44½

Bonds	Closing Bid	Asked	Week's Range or Last Sale		Year's Range	
Colo. F. & I. gen. s.f.g 5s	98	99	98	Mar. '13	98	99½
Colo. F. & I. gen. 6s	....	....	107½	June '12	....	....
Col. Ind. 1st & coll. 5s. gu	78½	Sale	78½	79	78½	85
Cons. Ind. Coal Me. 1st 5s	....	80	85	June '11	....	....
Cons. Coal 1st and ref. 5s	....	94	93	Oct. '12	....	....
Gr. Riv. Coal & C. 1st g 6s	96	102½	102⅝	Apr. '06	....	....
K. & H. C. & C. 1st s f g 5s	....	....	98	Jan. '13	98	98
Pocah. Con. Coll. 1st s f 5s	85	87⅜	87½	87½	87½	87½
St. L. Rky. Mt. & Pac. 1st 5s	76	Sale	76	76	76	80
Tenn. Coal gen. 5s	101	102½	100½	Mar. '13	100½	103
Birm. Div. 1st consol. 6s	101½	102½	101⅛	Mar. '13	101⅛	103
Tenn. Div. 1st g 6s	....	103¾	102	Feb. '13	102	102
Cah. C. M. Co. 1st g 6s	....	....	110	Jan. '09	....	....
Utah Fuel 1st g 5s	....	....	....	....	....	....
Victor Fuel 1st s f 5s	....	84	79½	Feb. '13	79½	79½
Va. I. Coal & Coke 1st g 5s	94½	Sale	94½	95	94½	98

Reading Co.—Regular quarterly dividend on the common stock of 2%, payable May 8, to holders of record Apr. 21.

St. Louis, Rocky Mountain & Pacific Co.—Regular quarterly dividend of 1¼% on the preferred, payable Apr. 5, to holders of record, Mar. 27.

Central Coal & Coke Co.—Regular quarterly dividends of 1½% on the common, and 1¼% on the preferred, payable Apr. 15 to holders of record Apr. 1.

Pittsburgh Coal Co.—Regular quarterly dividend on the preferred of 1¼, payable Apr. 25, to holders of record, Apr. 15.